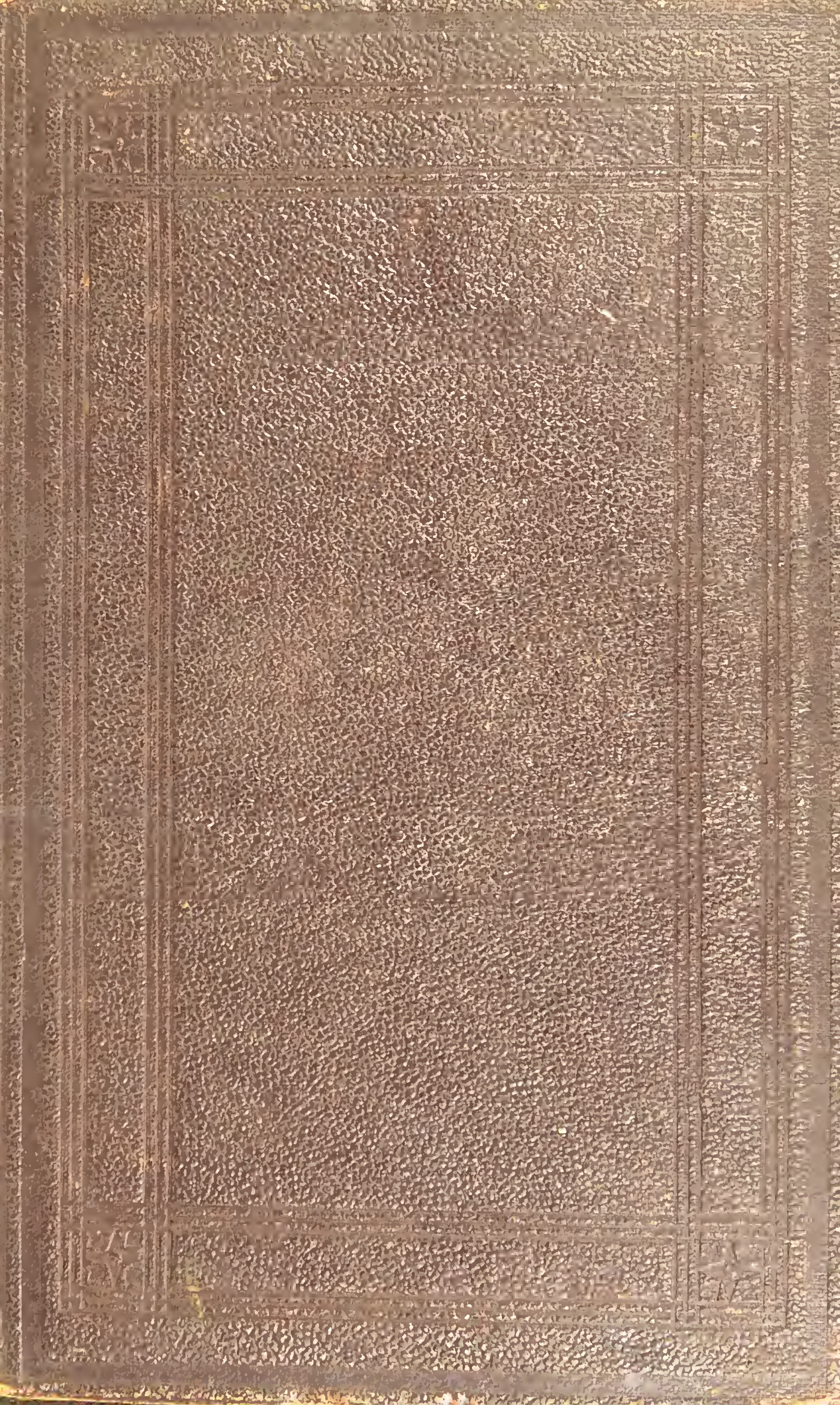

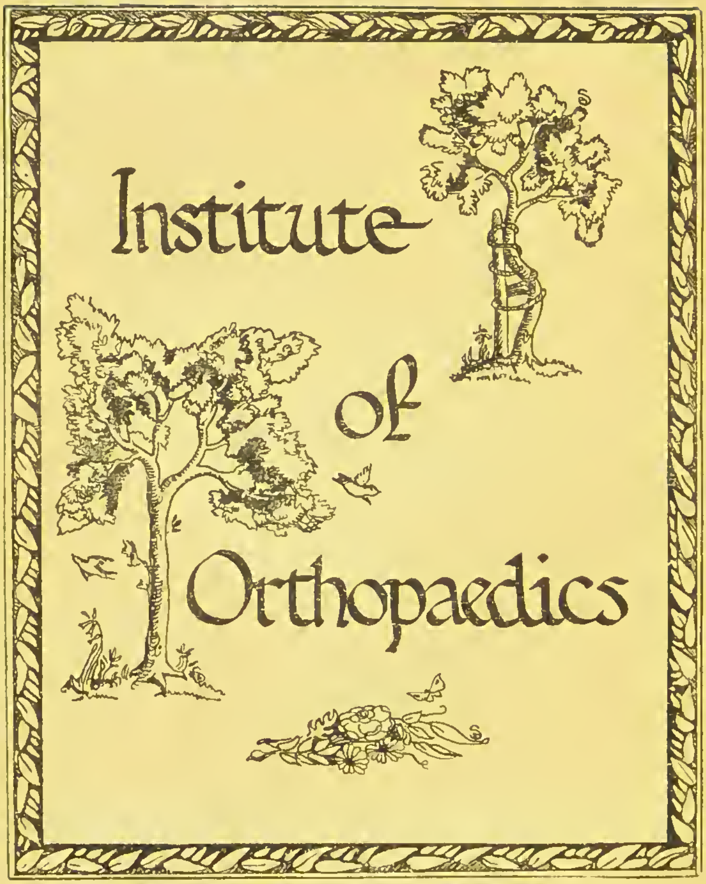

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In post 8vo, cloth, price 12s. 6d., Part I., containing copious Notes, and Illustrated by numerous Engravings, Drawn on Wood by the Author, from cases in his own practice,

BODILY DEFORMITIES,

By E. J. CHANCE, F.R.C.S.E., F.L.S., F.G.S.,

Surgeon to the City Orthopœdic Hospital, and Metropolitan Free Hospital.

Part I.—ON THE NATURE, CAUSES, AND VARIETY OF DEFORMITIES.—
(This Volume is complete in itself.)

Part II.—ON THE TREATMENT OF DEFORMITIES *(is ready for Publication.)*

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LONDON: T. T. LEMARE, PATERNOSTER
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ON THE

Nature, Causes, Variety, and Treatment

OF

BODILY DEFORMITIES:

IN

A SERIES OF LECTURES

DELIVERED AT THE CITY ORTHOPÆDIC HOSPITAL IN THE YEAR 1852
AND SUBSEQUENTLY.

BY

E. J. CHANCE, F.R.C.S.E., F.L.S., F.G.S.,

MEDICAL ASSOCIATE OF KING'S COLLEGE, LONDON;
SURGEON TO THE CITY ORTHOPÆDIC HOSPITAL;
SENIOR SURGEON TO THE METROPOLITAN FREE HOSPITAL;
FELLOW OF THE OBSTETRICAL SOCIETY;
FORMERLY LECTURER ON PRACTICAL ANATOMY AT THE ALDERSGATE AND HUNTERIAN
SCHOOLS OF MEDICINE, ETC. ETC.

WITH COPIOUS NOTES; AND ILLUSTRATED BY NUMEROUS ENGRAVINGS
DRAWN ON THE WOOD BY THE AUTHOR FROM CASES IN HIS
OWN PRACTICE.

IN TWO PARTS.

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(BY PERMISSION)

TO

W. J. LITTLE, ESQ., M.D.,

PHYSICIAN TO THE LONDON HOSPITAL,

AS AN ACKNOWLEDGEMENT OF THE BENEFIT THAT HAS ACCRUED

TO SURGICAL SCIENCE

AND

SUFFERING HUMANITY,

FROM THE INTRODUCTION AND PROMULGATION IN THIS COUNTRY

OF THE PRACTICE OF

SUBCUTANEOUS TENOTOMY.

PREFACE.

THE first six of the following lectures, *viz.*, those on the Nature, Variety, and Causes of Bodily Deformities, were originally written for, and intended as, a course to be delivered to the Students at the Hunterian School of Medicine, to which School I then (1851) held the appointment of Lecturer on Practical Anatomy; and the facts and experience they embodied had been acquired in the personal engagement in the treatment of such deformities—first, as Surgeon to the Society for Diseases of the Spine and Hip; and subsequently, from seven years' experience, as Assistant-Surgeon to the Royal Orthopædic Hospital.

As these Lectures were intended expressly *for Students*, the Nature and Variety of Bodily Deformities generally, and especially the nature of their *Exciting Causes*, were entered into in a much fuller manner than would otherwise have been necessary; and this plan was rendered the more needful as that part of the subject had not been, in my opinion, elucidated in a sufficiently comprehensive or connected manner in the works on Deformities previously published; indeed, I may say *even now*, that the *nature* of the *causes* giving rise to Deformities is only touched upon here and there in a cursory manner in any work that I have examined.

The foundation of the City Orthopædic Hospital in 1851, and my appointment to it as its Surgeon, rendered it necessary to alter all my arrangements, inasmuch as one of the regulations of that Institution was the formation of a Museum, and the delivery of public lectures on the subject for which it was established, viz., Bodily Deformities; and, consequently, such course of six lectures, instead of being delivered at the Hunterian School of Medicine, was given at the Hospital in June, 1852, and the profession generally, and the Students of the Hunterian and other Medical Schools were invited by advertisement to attend gratuitously.

By the regulations of the Hospital I was required, as the Surgeon, to give a course of lectures annually; but domestic affliction, and subsequently ill-health, prevented my fulfilling this duty until 1858, when I delivered a second course of twelve lectures, in which the treatment was included. These lectures, corrected by my subsequent experience, form the substance of the present work.

The opportunities that I have possessed for obtaining information on the subject, and for qualifying myself as a Lecturer on Orthopædic Surgery, have been very great, and I would fain hope I have not neglected them. Of these opportunities, I may classify them as General and Special. Of the first kind, viz., my General opportunities, I may refer—1st, to my former occupation as a public and recognised Teacher of Practical Anatomy; and 2ndly, to the position I have held for the last eighteen years as the Surgeon to a General Hospital, viz., the Metropolitan Free Hospital, at which institution the average attendance of patients for general ailments is 30,000 annually. Of the latter, viz., Special opportunities for acquiring information on the subject, I may refer to the position I have held for the last eleven years as Surgeon to the City Orthopædic Hospital, in which time upwards of 10,000 cases of Deformity have been brought under my immediate care; and, added to this, the experience previously obtained as Surgeon to the Society for Diseases of the Spine and Hip; and Assistant-Surgeon to the Royal Orthopædic Hospital.

To the above opportunities for acquiring information on the special subject of Deformities, I have not neglected the writings of those gentlemen who have preceded me on this subject; and I trust it will be found that wherever I have availed myself of the benefit of their labours, that I have also freely and fully acknowledged the source whence my information was obtained.

I have also drawn largely from the works of the first physiologists and anatomists; but in these cases, as in the former, I have in every instance appended my acknowledgment of the fact by a reference to the author's work; and I will here avail myself of the opportunity to express my sense of the value of the various works, special and general, and thanks to their authors for the service they have been to me.

The illustrations throughout the work are mostly from cases that have occurred in my own practice, private or public. Those that are not so, are copied from works of general physiology, &c., and the source from whence taken acknowledged. The diagrams of the various deformities, &c., with my initials, E. J. C., appended, were all drawn from the casts, and *on the wood* by myself, and I can therefore assert that they are all faithful representations of the cases referred to; casts of which, in nearly all cases, have been preserved in the Museum of the Hospital, and may be viewed by any one who is desirous of verifying their accuracy. They are preserved and numbered for this purpose, the same as the number of the diagram in this work.

In conclusion, I must beg to observe that although I have studied to avail myself of every source of information in my power on the subject, whether special or general; nevertheless, I have endeavoured to view the subject of Deformities in my own way as a whole, instead of following the path marked out by my predecessors of treating each Deformity separately.

Whether I have been right in so doing, as also whether I have in any, even the slightest degree, added to the general information on the subject, I must now leave to the decision of the medical profession.

E. J. CHANCE.

59, OLD BROAD STREET,
May 1*st*, 1862.

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INTRODUCTION.

The treatment of bodily deformities until very lately was entirely in the hands of the mechanist or the empiric;—indeed, so little was known of the pathology, or of the appropriate and scientific treatment of bodily deformities, that the medical profession as a body considered the subject so beneath their notice, that only a solitary individual here and there was found possessed of sufficient hardihood of character to encounter the deriding sneer of his professional brethren, that was conveyed in the words, "*Oh, he is a specialist*," or its *then* synonym, "*quack*," which sneer was certain to follow the announcement that any *member of the profession* undertook the treatment of such cases as disease of the spine, club-foot, or other like affections.

Within the last twenty-five years, however, these two terms, *viz.*, specialist and quack, have become widely separated in meaning, in consequence of the great change that has arisen in the medical profession itself, from the gradual and extensive introduction, by the *leading members* of the *medical profession*, of the practice of directing their attention more especially to some particular branch of medicine or surgery. I will, therefore, attempt a brief sketch of the chief causes that have effected such a change.

Wherever human beings are congregated together in large numbers, and exposed to diseases and dangers, as in large cities, or on the battle-field, it is evident that such places must afford more extended opportunities for studying the diseases and injuries that may arise, than can be met with elsewhere; and that a far larger number of cases of any given kind will be brought under the notice of a single individual from year to year, than he could see in a life-time under other circumstances; moreover, under these latter circumstances the cases would occur at such distances of time apart from each other, that the whole interest in them, and power of contrasting the one with the other, would be lost. In the situations to which I have alluded, however, the cases of disease and accident of every kind, are sufficiently numerous to allow of the physician or surgeon, (especially those attached to large hospitals, or to the army,) to select and study any disease or accident that in his judgment had not received sufficient attention.

In this mode, and from this cause, *viz.*, the desire to elucidate the pathology, and improve the treatment of a given disease, and, it is not impossible, stimulated also by their own interest, certain gentlemen of talent and station in the profession began to direct their attention more particularly to some one disease or ailment, at the hospitals or institutions to which they was attached as Physicians or Surgeons.

Among these early originators of this modern Special practice, I may mention the name of Sir B. C. Brodie, who, in addition to his general Surgical duties at St. George's Hospital, undertook the important investigation of the nature, &c., of the diseases of the Joints, including Caries of the Spine,[1*] thus establishing for himself a reputation in that branch of Surgery or Specialty, which he retains to this day, and thereby most justly reaping the fruit of his former labour.

In this manner much most valuable information was accumulated and *promulgated to* the *profession at large*, and we cannot fail to notice, that although this was the evident commencement of the *present Special* practice, how widely it differed from that (the special practice) of an earlier date, in which an individual member of the profession, or much more frequently an uneducated person, engaged in the treatment of a single disease, and confined his attention to that disease alone. Moreover, it is remarkable, that during such time as any given branch of medicine or surgery was confined to the care of the *absolute* specialist, its *treatment was a secret*,[2*] and it was used solely for his *own gain*, so that neither improvement in the treatment of the cases themselves, nor additional information was added to our general knowledge; but no sooner was any one of these branches undertaken by the physician or surgeon who only viewed them as *a part of one great science*, than an enlarged comprehension of the disease and improvement in practice directly followed.

An improvement in the mode of treating disease, however, was not the only good that resulted from the cultivation of these departments of medicine and surgery, by men of higher standing, inasmuch as the *public*, ever ready to advance and support by their liberality any undertaking having for its object the general good, soon appreciated the object, and furnished the funds, by means of which there has arisen around us separate institutions for the *special* treatment of this or that calamity or ailment, which special institutions are *in reality* but *more perfect parts of one great whole*, inasmuch as, with very few exceptions, the physicians or surgeons selected to preside over them, have always been those already attached to other institutions or hospitals, thereby bringing to bear *on the special subject*, the cultivated judgment and enlarged comprehension of disease that had been acquired in the *general study* of medicine, and by familiarity with disease generally;—while, in return, the perfection to which some of these branches have been brought is such as to shed a resplendent light on medicine and surgery generally, which latter in its turn is doubtless destined to react upon the parts, and thus lead to further discoveries and improvement.

[1*] "Pathological and Surgical Observations on Diseases of the Joints," by Sir B. C. Brodie, Bart., F.R.S., 1826.

[2*] An excellent example of this was furnished by Dr. Leuw, of Gräfrath, in Germany, whose patients were so numerous that the whole village was used for the lodging of them. His practice was a profound secret, and died with him.

I will endeavour to exemplify my meaning. The battle-field, with all its horrors, has not been permitted to pass by, thanks to a Ballingall, a Guthrie, and a Rutherford Alcock, without yielding its dearly-bought portion of improvement to the science of surgery, inasmuch as the numerous cases of accident and mutilation that were constantly being brought under their notice, led the comprehensive judgment of those gentlemen to the recognition and *promulgation* of many improvements in the practice of general surgery, and to the appointment of distinct lectureships, and the publication of special treatises on military surgery, and even to its recognition by the examining bodies as a *separate* branch of study, or *specialty*.

The poor idiot, or maniac, who until recently was chained and goaded worse than any animal, now finds his condition, though still wretched enough, so much improved that he is treated as a human being, and his feelings and even pleasures consulted,[3*] and all this, thanks to a Pencl, a Gardner, and a Conolly, is due to the improved treatment adopted by them within the last few years, as the result of their observations on the numerous cases brought under their notice at one time in the institutions to which they were attached. As in *military surgery*, so again in *mania*, we have a complete *specialty*—indeed, the greatest specialty of the day.

Among the numerous patients that are brought together at the larger hospitals, some of which speak of their tens of thousands per annum, it was an easy task to collect together a considerable number with a particular disease or injury; for example, the affections of the eye, which some few years back were but imperfectly known, although there were many *absolute specialists* who directed their attention to that organ alone, and such was therefore done by a Lawrcnce, a Travers, a Guthrie, and a Beer, at the *General* Hospitals to which they were attached; and more recently, at the institutions ("Ophthalmic Hospitals"), founded for the express purpose of treating diseases of the eye only, by a Morgan, a Bowman, a Critchett, and a Wharton Jones; all of whom, in addition to these *special* appointments, held appointments as *general surgeons* to other and larger institutions; and, as a result of the treatment of these affections by such men, this branch, or *specialty*, *viz.*, "*ophthalmic surgery*," has become one of the brightest ornaments of the general science.

[3*] I have just seen a printed programme of a concert and dance to be held at the County Lunatic Asylum, Stafford, for the amusement of its inmates.

It would be an easy task to multiply these examples of the mode in which *specialties* have grown up around us in the last half century. I shall, however, content myself with merely enumerating some of the chief special hospitals and dispensaries which exist at the present day, and which are maintained solely for the treatment of such special cases. For example: The Hospitals for Diseases of Children; The Hospitals for Consumption; The Fever Hospital; The Small Pox Hospital; The Lying-in Hospitals; The Ophthalmic Hospitals; The Orthopædic Hospitals; The Epileptic Hospital: The Hospitals for Lunatics; The Hospital for Fistula; The Hospital for Syphilis (Locke); The Spinal Hospital; The Hospital for Diseases of the Skin; &c.; and in addition to these, there are the various Dispensaries and Infirmaries for the same and other *special* affections.

It is evident from the foregoing list that the tendency of the age *in the medical profession*[4*] is to the subdivision of labour, acting on the undoubtedly correct principle, that the greater the perfection of *the parts*, the greater the perfection of the whole;—while, on the part of *the public*, they have also become keenly alive to the fact, that when duly educated and admitted members of the profession engage in a *special* study, in *addition* to their *general* practice, that they become more skilled in the treatment of such *special* medical or surgical ailments, than those engaged in general practice solely; and as a consequence, in the hour of need, they seek the aid of such special practitioner in preference to any other.

[4*] The Royal College of Surgeons of England, within the last few years, has directly upheld specialties; for example, they had granted 122 *Special* Diplomas in Dental Surgery, prior to November, 1860. They have also granted numerous Diplomas of Qualification in Midwifery. Here are, therefore, two direct specialties upheld by the Diploma of the Royal College of Surgeons.

It is a significant fact, corroborative of this tendency of the age, and of the acknowledged benefit resulting to general society therefrom, that the *medical* profession itself, in the hour of need, like the public at large, avail themselves to a certainty of the *specialist*, thereby loudly proclaiming his value; for example, in the affliction which recently fell upon the member of our profession whose name is venerated by every English surgeon, and whose resplendent talent is acknowledged by the profession of every nation, to whom did he have recourse? To one of his numerous friends occupying the position of *general* surgeon only to a large hospital? or to the gentleman who, in addition to his general appointment, was *the specialist par excellence* for that particular malady? The profession and the world alike are equally aware it was to the *specialist;* and thus it will be found with the profession throughout. Is it the chest of the beloved wife or child of Dr. A. or B. that is afflicted? It is Dr. ———, of a Consumptive Hospital, whose advice is sought. Is it puerperal? It is Dr. ———, of a Lying-in Hospital. Is it the eye? It is Mr. ———, of an Ophthalmic Hospital. Is it club foot? It is Mr. ———, of an Orthopædic Hospital; and so on throughout the category of specialties; and well may they do so, for if the names of all the members of the profession who are connected with *special* institutions were selected from the Medical Directory, and published, the list would contain a very large section of the *most talented and honourable* men of the profession, the *great majority* of whom hold *other and general appointments;* many, at the *larger* hospitals.

Within the last year, however, judging from the letters directed against *special hospitals* that have been published in the public newspapers and *medical* journals, it would appear at *first sight* that a positive change had come over the medical profession, and that that which they had themselves originated as a benefit to the public, and to the *advancement of medical and surgical* science, had all at once been discovered to be a mistake. I shall, therefore, enter a little into this matter, and examine *the cause* of the violent and public attack on the *special hospitals* made by Sir B. Brodie and others in December, 1860, in order to dissuade the public from supporting such charities.[5*]

In the course of the year 1860, some gentlemen conceived the idea, and organized the plan of a special hospital for "Stone, and Diseases of the Urinary Organs," and eventually succeeded in establishing such an institution. Now every surgeon knows that Stone is a disease of limited occurrence, and I believe I am correct in stating that not more than fifty (I have heard only forty) such cases are operated on per annum in the London hospitals (*i. e.*, on an average four or five per annum each). It is, moreover, an operation that requires great skill in the operator, and is of great practical interest to the student; consequently, the formation of a *special hospital* for an affection of so *important* a nature and of *so limited* an occurrence, *was* calculated to withdraw *and has withdrawn* from the larger hospitals and schools of medicine and surgery some of those cases which *every operating surgeon* was constantly searching to obtain for his own reputation and his pupils' advancement.

[5*] A verbatim copy of this protest is given in the Appendix, p. 273.

That an attempt to arrest the formation of *this special hospital for Stone, &c.* should be made by operating surgeons generally was natural enough, as *its* establishment materially affected their *individual interests*, both as regards the interest of the School to which they were attached, and—why hide it?—both directly and indirectly their own reputations and pecuniary interests; but the attempt was made in an *indirect*, and as regards *other specialties*, in an *unfair* manner, as it was levelled *ostensibly* against all "*small*[6*] institutions under the name of Hospitals for particular forms of disease," and only as by a mere afterthought or "as an example *that the evil referred to is increasing*," the real offending cause was lightly touched upon, *viz.*, the projected "Hospital for Stone."[7*]

[6*] The word "*small*" is printed in Italics in the protest, thereby clearly indicating that, in the opinion of the gentlemen who have signed it, *the size of a building*, in which the Institution or Hospital is carried on, is a matter of supreme importance, and a gauge of its usefulness. To this opinion some like myself may dissent, and maintain that a small building may be the centre of doing quite as much good as a building that is ten or twenty times as large, even with such serious calamities as "Stone," and I will just instance one to which I am myself attached, *viz.*, the Metropolitan Free Hospital, which consists of only two private houses in Devonshire Square; yet at that "small" Hospital no less than 30,788 patients were admitted to treatment in the year 1860; and although we have but twelve beds, one of my colleagues (Mr. G. Borlase Childs) has had within the last six or seven years twenty-four cases of Stone, *on which* HE *has operated, and* HE HAS YET *to lose his* FIRST *case.* This is an amount of success that

That the real animus of this *public* protest should escape detection was doubtless expected, but the hope was vain, and not only did the protest not prevent the establishment of the "Hospital for Stone," but it has caused *the public* to become more keenly alive to the benefit the *special hospitals generally* are to themselves, rich as well as poor; and to openly laugh at the impotent and selfish attempt to monopolise the public charitable funds for the large Hospitals, and to confine professional reputation to themselves, as the medical officers connected with them.

Having thus shown the real cause of that letter, I cannot refrain from answering the second and chief

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no large Hospital in London that I have heard of can show an approach to, and therefore proving that *all* the *tact* and *skill* is not centred in a *large* Hospital; and that even Stone can be not only quite as well, but even better treated in a small Hospital than in a large one.

[7*] It appears from the following quotation that the London Surgeons are not alone in their complaints, for the Surgeons to the Parisian Hospitals are also making the same outcry against specialties. "The winter session of the Paris Faculty of Medicine opened on Friday last. . . . . . In the course of his report on M. Lefoot's paper on Hip-Joint Resection, Mr. Gosselin incidentally mentioned that one of the causes which prevented the majority of the Parisian Hospital Surgeons from witnessing many cases of this disease, was the fact that nearly all such examples were absorbed by the Special Hospitals—meaning, of course, the Hospital des Enfans Malades, and the Eugénie."—*Lancet*, Nov. 23rd, 1861, p. 509.

reason assigned by Sir B. Brodie, and the gentlemen who have signed it with him, *against* special hospitals, *viz.*, "because the public is led to believe that particular classes of disease can be more successfully treated in the small special institutions than in the general hospitals —an assumption directly contrary to evidence ; the fact being, that the resources of General Hospitals are in every respect superior to those of the Special institutions alluded to." To this statement I unhesitatingly answer —1st, "*and so they* (the particular forms of disease) *can be* more successfully treated in *the small* institutions, as is daily proved by the poor seeking and obtaining that relief at the small hospitals, which they had sought, *but obtained not*, at the larger institution; and 2ndly, as to the *superior resources* of the General Hospitals, this every one will at once allow, but I must beg to hint that it is the MEN connected with the institutions (small or large), *who cure* the disease, and *not* the "superior resources." That the gentlemen connected with the *Special* Hospitals[8*] are qualified in their several departments of the science beyond *those engaged solely in the general practice* of a Hospital, however large the hospital they belong to, is a fact that the experience of every day testifies, and the profession generally acknowledges, by having recourse to them in their own necessities. In proof of this I will select two examples—the Eye and the Foot—in other words, the Ophthalmic and the

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[8*] Of course where a General Hospital has a special department connected with it, as the Ophthalmic department of Guy's, and has an officer appointed to that Special department; then, in that case, it is in exactly the same condition as a separate Special Hospital, and its officers equally experienced.

Orthopædic specialties. Of the first of these facts I will cite Sir B. Brodie as a living witness; and of the latter, I have no doubt that every surgeon connected with an Orthopædic Institution can advance proof, by instancing the members of the medical profession whose children or relations they have treated, or operated on.

I cannot quit this subject, however, without noticing the extraordinary fact that, notwithstanding all the profession has done to foster the growth of special practice, the name *specialist* is still nearly as odious as ever, each man clinging to the delusive idea that *his* selecting the Eye, or Consumption, or Mania, or Midwifery, or Club-foot, or Epilepsy, or the Skin, or Fistula, or Syphilis, or the Ear, is not a specialty; and that whoever else may be, *He* is not a *specialist.* To this feeling, and to this feeling alone, I feel assured must be attributed the fact, that forty-three gentlemen, each of whom is connected with a *Special* Institution, have signed the protest with Sir B. Brodie and others, against *Special* Hospitals. Each gentleman had, doubtless, forgotten or *ignored* the fact, that *He* himself was a *specialist.* I append the names of the gentlemen, as also the *institutions* to which they are attached,[9*] and, as *they* published their *own* names with the protest against Special Hospitals, I hope they will excuse my claiming them as *specialists*, and re-publishing them as such, in these my observations against the *injustice* of that protest; and I do this the more freely, because, as I stated previously, *I* myself maintain that the greater part of the *most talented*, *most honourable*, and *highest* members of the profession at the present day, are either directly or indirectly connected with a specialty, and therefore I use the word specialist as one of *distinction*, and not, as formerly, of disparagement; and I refer to this list as a corroborative proof that I am right in maintaining such an opinion.

[9*] The names were copied from the list of signatures to the protest published in the *Medical Times* of December 8, 1860; and the Special Institution, &c., to which they are attached were copied from the accounts furnished by *themselves* to the *Medical Directory*, and published January 1, 1860.

NAME.	SPECIAL HOSPITAL, &c.	GENERAL HOSPITAL.
Adams, John	Cons. Surg. Inf. Asthma & Diseases of Chest	Surgeon, London Hospital
Bennett, J. R., M.D.	Phys. City of Lond Hosp. for Diseases of Chest	Phys. St. Thomas's Hosp.
Canton, E.	Cons. Surg. Kent County Ophth. Hospital	Surgeon, Charing Cross Hospital
Cock, E.	Cons. Surg. Asylum Deaf & Dumb	Surgeon, Guy's Hospital
Cooper, W. White	Sen. Surg. North London Eye Infirmary	Surg. and Lect. on Ophth. Surgery, St. Mary's ,,
Coote, Holmes	As. Surg. Roy. Orthopædic Hospital	As. Surg. St. Bartholomew's Hospital
Copland, J., M.D., F.R.S.	Cons. Phys. and formerly Sen. Phys. to Royal Inf. for Children; late Cons. Phys. Q. Charlotte Lying-in Hospital	Late Physician, Middlesex Hospital
Critchett, G.	Surg. Royal Lond. Ophth. Hospital	Surgeon, London Hospital
Cutler, E.	Cons. Surg. Locke Hosp.	Surg. St. George's Hospital
Ferguson, Robert, M.D.	Formerly Phys. Gen. Lying-in Hosp., York Road	Phys. King's Coll. Hospital
Flower, W. H.	Surg. North Lond. Eye Inf.	As. Surgeon, Middlesex ,,
Forster, J. Cooper	Surg. Royal Inf. for Childr.	As. Surg. Guy's Hospital
France, J. F.	Surg. Eye Inf. (Guy's)	As. Surg. Guy's Hospital
Gascoyen, G. G.	As. Surg. Locke Hospital	Surgeon, St. Mary's Hospital
Gay, John	Cons. Surg. Idiot Asylum, Earlswood	Surgeon, Great Northern Hospital
Hancock, Henry	Surg. Roy. Westm. Ophth. Hosp.: late Surg. Roy. Inf. for Children.	Surgeon, Charing Cross Hospital

NAME.	SPECIAL HOSPITAL, &c.	GENERAL HOSPITAL.
Henry, Mitchell	Surg. Middlesex and North London Ophth. Hospital	Surgeon Middlesex Hosp.
Hillier, Thomas, M,D.	As. Phys. Hosp. for Sick Chil.	Res. Med. Off. Univ. Col. ,,
Holmes, T.	As. Surg. Hosp. for Sick Children	As. Surgeon, St. George's Hospital
Holthouse, Caesten	Surg. South London Hosp. for Eye	Surgeon, Westminster Hospital
Hulke, J. W.	Surg. Royal London Ophth. Hospital	As. Surgeon, King's College Hospital
Jenner, W., M.D.	Phys. Hosp. Sick Chil.; As. Phys. Lond. Fever Hosp.	Phys. University College Hospital
Jones, T. Wharton	Ophth. Surg. Univ. College Hospital	Surg. to the University College Hospital
Lane, S. A.	Cons. Surg. Locke Hospital	Surg. St. Mary's Hospital
Lawrence, W.	Cons. Surg. London Fever Hosp.; & formerly Surg. Lond. Ophth. Hospital	Surgeon, St. Bartholomew's Hospital
Lee, Henry	Sen. Surg. to Locke Hosp.	Surg. King's College Hosp.
Luke, James	Surg. St. Luke's Lunatic Hospital	Senior Surgeon, London Hospital
Mackenzie, F. W., M.D.	Phys. Accouch. Paddington Maternity	Phys. Westminster General Dispensary Hospital
Mackmurdo, G., F.R.S.	Cons. Surg. Royal London Ophth. Hosp., & Lect. on Ophth. Surgery	Surgeon, St. Thomas's Hospital
Murchison, C., M.D.	As. Phys. Lond. Fever Hosp.	As. Phys. King's College ,,
Oldham, Henry, M.D.	Lect. on Midw. and Diseases of Women & Chil. at Guy's	Obstet. Physician, Guy's Hospital
Peacock, T. B., M.D.	Phys. City of London Hosp. for Diseases of Chest	Assist. Phys. St. Thomas's Hospital
Poland, A.	Surg. Royal Ophth. Hosp.	As. Surg. Guy's Hospital
Pollock, G. D.	Surg. Rupture Society	As. Surg. St. George's ,,
Quain, R.	Cons. Surg. Eye Infirmary	Surg. University College ,,
Ramsbotham, F. H., M.D.	Obstet. Phys. to London Hosp.; late Phys. Royal. Maternity Charity	Obstet. Physician, London Hospital
Smith, Tyler, W., M.D.	Lect. and Phys. Accouch. St. Mary's	Phys. Accouch. St. Mary's Hospital
Toynbee, James, F.R.S.	Aural Surg. St. Mary's Hosp. Cons. Surg. Asyl. Deaf & Dumb; Aural Sur. Asyl. for Idiots	Aural Surgeon, St. Mary's Hospital
Waller, C., M.D.	Phys. St. Thomas's Lying-in Charity	Obstet. Phys. St. Thomas Hospital

NAME.	SPECIAL HOSPITAL, &c.	GENERAL HOSPITAL.
WALSHE, W. H., M.D.	Cons. Phys. Hosp. for Consumption	Phys. University College Hospital
WALTON, HAYNES	Surg. Central Lond. Ophth. Hospital	Surg. St. Mary's Hospital
WILLIAMS, C. J. B., M.D....	Cons. Phys. Hosp. for Consumption	Late Phys. University College Hospital
WILLSHIRE, W. H., M.D....	Phys. Royal Inf. for Childr.	As. Phys. Char. Cross Hosp.

Having offered these remarks upon the prevalent practice of *specialties*, I will now address myself to the *Specialty* of *Bodily Deformities*, and trace its origin in this country.

At the end of the last century, the amount of surgical knowledge of the treatment of Club-foot is most graphically described by *Cheselden*, in his 12th edition of his work on Anatomy, published in 1784, page 37:—He says, "Children are sometimes born with their feet turned inwards, so that the bottom of the foot is upwards; in this case the bones of the tarsus, like the vertebræ of the back in crooked persons, are fashioned to the deformity. *The first knowledge I had of a cure of this disease was from Mr. Presgrove, a professed bone-setter*, then living in Westminster. I recommended the patient to him, *not knowing how to cure him myself.* His way was by holding the foot as near the natural position as he could, and then rolling it up with strips of sticking plaster, which he repeated from time to time as he saw occasion, until the limb was restored to a natural position; but not without some imperfection, the bandage wasting the leg, and making the top of the foot swell and grow larger.

"After this, having another case of the kind under my care, I thought of a much better bandage, which I had learned from Mr. Cowper, a bone-setter of Leicester, who set and cured a fracture of my own cubit when I was a boy at school. His way was, after putting the limb in a proper posture, to wrap it up in rags dipped in whites of eggs and a little wheat flour mixed; this drying grew stiff, and kept the limb in a good posture, and I think there is no way better than this in fractures, for it preserves the position of the limb without strict bandage, which is the common cause of mischief in fractures; when I used this method to the crooked foot, I wrapped up the limb almost from the knee to the toes, and caused the limb to be held in the best posture till the bandage grew stiff, and unpeeled the bandage once a fortnight."

In the beginning of the *present* century we continued as a profession, equally unacquainted with the subject, and incompetent to treat them, as may be gathered from the following extract from a work entitled, "An Appeal to the Public," published in 1810, by Mr. Sheldrake, the truss-maker to the East India Company, and formerly to the Westminster Hospital. In this work Mr. Sheldrake attacks Mr. Abernethy and certain other surgeons of eminence, for some real or imaginary injury he had received at their hands, about some cases of deformity that had been sent to him by them. He says in the first page, "When I directed my attention to the cure of distortions of the legs and feet of children, and other defects in the human form, that may be either cured or alleviated by the skilful application of mechanical inventions, I did not imagine that I could give offence to any human being by engaging in the pursuit: *no man who practised surgery would attempt to do anything for patients who laboured under such diseases;* when gentlemen of that profession were applied to, they got rid of the applicants either by saying plainly that they were incurable, or that something might be done to assist them by the makers of instruments; even these men, considering them as merely mechanical, were but ill qualified for the task, and in consequence the number of patients' distorted limbs did not diminish;"[10*]—and from the following letter from Mr. Abernethy, proving his inability to treat such cases; and that for that reason he sent them to the mechanist.

" *Bedford Row*, 15*th April*, 1801.

" SIR,—Having witnessed your success in the treatment of the clubbed foot, in a little girl whom I recommended to your care at Turnham Green, I am desirous of requesting your attention to a case which is, in my opinion, similar in respect to the leading circumstances. It appears to me, that in the present instance there is a predominancy in power and disposition to act in some of the muscles of the leg and foot, over their natural opponents. As your mode of treatment must primarily act upon the muscles, it is reasonable to expect it may be beneficial in the present case.—I am, Sir, yours, &c.

" To Mr. Sheldrake." " JOHN ABERNETHY."

That the general body of surgeons spurned the treatment of these cases 35 years later (1836), every surgeon who has been 25 years in practice can certify of his own knowledge; indeed, they not only spurned it themselves, but also openly testified their contempt for the individual of their body who attempted it. Of this latter fact,

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[10*] The condition of the patient is here clearly described. It is acknowledged *in*curable by the Surgeon, and not benefited by the ill-qualified instrument maker.

I was, soon after my entrance into practice, made fully aware, for having, in 1838, accepted the office of Surgeon to the Society for Diseases of the Spine, Hip, and other Deformities, I found in a short time its force brought to bear so strongly upon myself, although I held at the same time the appointment of Surgeon to a *General* Hospital, that I often contemplated giving up the treatment of *deformities* altogether, and doubtless should have done so, but for the occurrence of circumstances appertaining to the treatment of Deformities to be presently noticed.

The treatment of *club-foot*, more than any other deformity, at this period (1838) was still, as related by Mr. Sheldrake in 1810, in the hands of the *mechanist*, and the *pupils at the Hospitals never saw a case treated*, nor *heard* in any Lecture the *mode* of doing so, or the *principles* upon which it ought to be conducted.[11*]

In 1837, however, a great change in the profession had been commenced by the introduction into *this country* from *Germany* of a new mode of treating club-foot and other deformities, by subcutaneous section of the tendons of the muscles which opposed the restoration of the part to its proper position; and in 1839 we find evidence of the working of this change, and further *proof of the ignorance of the profession even then*, of the proper treatment of club-foot, in a review of Dr. Little's work upon club-foot, &c., published in the *Lancet* of November 1839. The author of that review observes, "The favour which charlatans have ever found in the eyes of this liberal and enlightened nation contributes in no small degree to retard the progress of medical science. On the Continent of Europe there are indeed quacks in abundance, but nowhere save in England do we find whole branches of the healing art seized by, and made the property of, the most ignorant pretenders to medical knowledge. We have, on more than one occasion, shewn that charlatans generally endeavour to appropriate to themselves certain operations or modes of treatment of diseases, which have been, comparatively speaking, neglected by the regularly educated medical practitioner ; hence we hail with particular pleasure any work of a scientific man which is calculated to diffuse a general knowledge of complaints that have been hitherto neglected, or allowed to remain in the hands of ignorant peripatetics."

[11*] The first case of club-feet (Talipes Equinus) that I ever saw operated on was in 1839. The patient was under the care of my then colleague (at the Society for Diseases of the Spine and Hip, &c.), the late Dr. Verall, and the operation was performed by Mr. Lawrence, who divided the tendo-achillis subcutaneously. I never saw a case treated at the Middlesex Hospital, although I was dresser to Mr. Mayo for nearly nine months.

"The treatise of Dr. Little is of this latter class ; it contains the most ample information on distortion of the foot, a species of malady which, as our readers well know, is, even at the time we write (1839), submitted to the care of carpenters and cobblers."

The result of the introduction into this country of this new mode of treatment has been the removal of these cases entirely from the hands of the mechanist into those of the Surgeon ;—the study of the peculiarities of the individual deformities ;—and the establishment of correct and scientific principles of treatment ; the foundation of *at least three* public institutions devoted especially to their relief ; and lastly, the recognition of *orthopædic surgery* as a branch of *legitimate medicine*. The credit of *introducing into this country* this new mode of treatment, and of being *the first* in England[12*] to promulgate by his writings (1839) and lectures (1853) a scientific knowledge of deformities generally, is due to Dr. Little, who had become acquainted with it during a residence in Germany, while attending Stromeyer's practice at Berlin; and more especially in consequence of his having experienced its benefits in his own person.

The steps by which this advance in the surgical treatment of club-foot was effected, is thus described by Dr. Little in his lectures on the Nature and Treatment of Deformities, page 4:[13*] "The names that showed foremost among the regenerators of orthopædy are those of Thilenius, a physician of Frankfort, who first (about 1789) caused division of a contracted tendo-Achillis to be effected; of Scarpa, who first (1803) attempted the scientific adaptation of an apparatus to the *anatomical* condition of the bones of the distorted foot; of Michaelis (1811) and Sartorius, who repeated the operation of Thilenius; of Dupuytren, who investigated the pathology of contracture of the fingers, and improved the operation for wry neck; and of Delpech

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[12*] In 1838 there was published in France, by Le Docteur Jules Guérin, a work entitled "Mémoire sur l'Etiologie Générale des Pieds-bots Congénitaux; Lu à l'Académie Royale de Médicine, le 11 Decembre, 1838:" and in the year following (1839), a second, entitled. "Mémoire sur les Variétés Anatomiques de Pied-bot Congénitaux dans leurs rapports avec la Retraction Musculaire Convulsive: présenté à l'Académie Royal des Sciences, le 18 Mars, 1839."

[13*] It will be observed that the dates specified at which each of these advances in treatment were made, correspond exactly with the account I have given of the state of medical knowledge as regards deformities from Cheselden to 1840.

(1823-29), who perceived the cause of previous failure, but who omitted to act on the principles he had adopted. The labours of Delpech, though calculated to arouse the attention of surgeons, remained apparently unheeded until they evoked the talents and ardour of Stromeyer (in 1830,) to whom is due the discovery of *subcutaneous* tenotomy, its application to club-foot, and its establishment as a *principle* in operative medicine."

The principle of *subcutaneous* tenotomy, upon which the success depends, is thus described by Dr. Little as the discovery of Stromeyer alone; but this honour is also claimed by French surgeons for their countryman Delpech, who in his *Orthomorphie*, two years before, *viz.*, in 1828, tome ii. p. 330, describes the mode of dividing the tendon in exactly the terms that I should use now; but it is a singular fact that Delpech never put into practice that which he advised: nor does he even hint that he ever saw any one divide a tendon in the manner he recommended. He, himself, reports that in 1816, *i.e.*, 13 years before he wrote, he operated on a youth for the most simple form of club-foot (Talipes Equinus); but if his own account of that operation is to be received as evidence of his mode of procedure, how different is that operation from the directions given in 1828. According to his own account,[14*] Delpech passed an ordinary scalpel quite through the limb beneath the tendo-achillis, and made an incision an inch long on each side of the tendon. After the withdrawal of the scalpel, the tendon was divided obliquely by a curved bistoury. Fever; inflammation of the wound; suppuration around the tendon and up the leg and thigh; and exfoliation of a part of the tendon, were the sequelæ of this operation; and although the lad ultimately recovered, Delpech never appears to have incurred the risk of encountering so much trouble and anxiety again by repeating his operation. Indeed, it would appear that he even had the vivid remembrance of these dangers before him when he wrote the directions for dividing a tendon, which were published in his *Orthomorphie* 12 years afterwards (1828), as he there adds, "without this precaution, risk of exfoliation of the tendon is incurred."

[14*] "Chirurgie Clinique de Montpelier par le Professeur Delpech, pp. 184–189. 1823.

Whether *subcutaneous* division of the tendons was the offspring of Stromeyer's unaided reasoning and experience, or was taken up by him after becoming acquainted with it from the writings of Delpech, is a matter of but little consequence either to Stromeyer or to ourselves. To Stromeyer *is unquestionably due*, that which *cannot be claimed* for Delpech, *viz.*: the far greater merit of *practically carrying into effect* a successful principle of treatment of club-foot which has, through his teaching and practice *spread throughout the world.* To us, it is of no consequence which gentleman first *thought* of the plan, or whether it was an original idea in each, but as a profession we have unquestionably derived great benefit from the *labours* of Stromeyer, and from the *introduction of his mode of treatment* into this country by his pupil and patient Dr. Little. To both these gentlemen, therefore, we, as a profession, are bound to award our most cordial thanks; and I avail myself of the present opportunity to do so most fully and frankly, in the firm conviction that the *profession generally entertain the same feeling.*

ERRATA.

PAGE	LINE	
46	24	*for* "Allen" *read* "Allan."
„	35	„ „
54	9	*after the words* "of the R. C. of S." *insert* "Part V."
61	14	„ „
70	12	*for* "Allen" *read* "Allan."
„	25	„ „
75	7	„ „
86	last line,	*for* "Pritchard" *read* "Prichard."
124	13	*for* "whi chcan" *read* "which can."
125	32	*insert* "in" *before* "the centre."
133	16	*insert* "of" *after* "fibula."
„	last line,	*for* "areb ut" *read* "arc but."
164	9	*for* "spectable" *read* "spectacle."
209	last line,	*for* "130" *read* "139."
234	7	*for* "week" *read* "neck."
257	3	„ "fourth" „ "third."
284	6	„ "hypothesis" *read* "hypotheses."
286	29	„ "Vrolick" „ "Vrolik."

PART I.

LECTURES
ON THE
NATURE, CAUSES, AND VARIETY
OF
BODILY DEFORMITIES,
DELIVERED AT
The City Orthopædic Hospital.

SYNOPSIS OF LECTURE I.

The Form of the Human Body and of all Vertebrate Animals dependent on the Internal Skeleton—Consideration of the modes in which the Natural Skeleton as a whole influences the External Form of the Body—The *Proportions* of the Body entirely dependent on the Skeleton: the *Contour* on the Muscles, &c.—Definition of Deformity, as understood in Surgery—Division of the subject Primarily, in accordance with the Definition, into the four following Groups, *viz.*, 1stly, The Period of Accession;—2ndly, The System operated upon by the Inducing Cause;—3rdly, The Nature of the Deviation produced;—and, 4thly, The Nature of the Inducing Cause itself—Considerations of the 1st Group, and its Subdivisions, 1stly, Original, and, 2ndly, Acquired Deformities—Consideration of the 2nd Group and its Subdivision into Deformities arising from, 1stly, Errors in the Osseous System;—2ndly, in the Muscular System;—3rdly, in the Skin;—4thly, in the Fasciæ;—5thly, in the Ligaments—Consideration of the 3rd Group, and its Subdivision, in accordance with the Nature of the Deviation producing the Deformity, into, 1stly, Deformities essentially consisting of an Alteration in the Number of the Bones; varieties produced:—2ndly, upon an Alteration in the Structure and Shape of the Bones; varieties produced:—3rdly, upon an Alteration of the Relative Position of the Bones; varieties produced:—and, 4thly, upon Simple Impeded Motion in the part; varieties produced.

LECTURE I.

The Form of the Human Body, as well as that of every Vertebrate Animal, mainly depends upon its Internal Skeleton, which not only gives attachment and support to the muscles and other soft parts surrounding it, but also constitutes a complete Framework upon which all the other parts of the Body are, as it were, built up; thus giving to each animal its individual character.

The pieces of which this Framework or Skeleton is composed are of various sizes and shapes: some round, some flat;—some long, some short;—some broad, some narrow;—some curved, some straight;—some possessing but one of these characters;—others possessing several; while one and all are united to the adjoining Bone or Bones, and converted into a whole by means of a dense fibrous and indistensible medium termed Ligament.

In some parts of the Skeleton the ligaments uniting the adjoining bones present the appearance of broad bands, spread out over their extremities or surfaces in contact with each other; while in other parts, they take the form of thick and roundish cords, which influence the external form of the Body, as much as if they were themselves portions of the solid Framework itself; moreover, they are so strong that in injuries from external violence, it frequently occurs that the solid bone itself becomes fractured sooner than the fibres of which the ligaments are composed will yield.

All these points, however, I need here only allude to as introductory to other matter, inasmuch as you are, as Anatomists, intimately acquainted with the Form and Structure of each of them as found in the Normal Skeleton; I shall therefore not detain you by any description of the individual bones or ligaments;—nor shall I hereafter introduce any such description;—except in special cases in which particular bones, or portions of them, or ligaments, are immediately under our consideration, as constituting some particular Deformity.

Although I do not consider it necessary to dwell more upon the individual bones and ligaments, composing the Natural Skeleton, nevertheless I am especially desirous at this period to draw your attention to them *as a whole*, and to lead you to examine the manner and extent to which certain portions of many of them influence the External Form of the Body.

In several parts of the Body the Skeleton beneath is clothed in by little more than skin and fascia, or a few tendons from the muscles in the neighbourhood, so that allowance being made for the rounding of its lines and angles by these thin coverings, the Form of the part *without*, corresponds closely with that of the Skeleton *within*. Examples of this arrangement may be seen in the anterior and lateral parts of the Knee;—the Ankles, the Instep, and Toes;—the back of the Hand and Wrist; the Skull, &c. In other parts of the Body, the Skeleton has superimposed upon it one or more layers of muscles, so as nearly to obliterate the external indications of the bones beneath, nevertheless, the whole *Character* of the part is entirely owing to it, for example, the Face, the Chest, the Pelvis, are instances of this arrangement: while in a third series of parts, the Skeleton beneath performs merely the office of regulating the length and inclination of the member, inasmuch as it is surrounded on every side by numerous large and powerful muscles, which completely prevent the slightest external indication of its presence from being manifested. Such an arrangement is found in the Thighs and Upper Arms.

From the examination we have just instituted it will be observed that the *Proportions* of the body are entirely regulated by the Skeleton within; *the Contour* by the Muscles and other soft parts adapted upon and to it: for example, the height, the size of the Head, the width of the Chest and of the Pelvis, the length and direction of the Limbs, the width of the Joints, are all points definitively fixed by the Skeleton, which cannot be altered or compensated for, by any extra development of the surrounding soft parts;—while the rotundity or leanness of the Limbs, of the Face, and of the Body, generally, is dependent upon the accidental greater or less development of the muscles and other soft parts surrounding the Osseous Framework. The Skeleton therefore performs the most essential part, and moreover, if it (the Skeleton) is originally accurately developed, it almost necessarily results, that the muscles are so likewise: whereas, on the contrary, if the Skeleton is abnormally developed, it absolutely prevents the proper development of the Muscles and other parts attached to it.

When the whole of these parts are properly adapted the one to the other: on the one hand, the bones accurately proportioned and firmly united to each other by their connecting ligaments; and on the other, the muscles, &c., properly and duly developed, and each of them in a state of integrity, we have the necessary conditions for the most perfect Form which the Animal or the Human Being is capable of receiving, and we may therefore regard this state as the "Standard of Beauty," or the "Perfection of Animal Form," from which, every deviation must be considered as a step towards its opposite, *viz.*, towards Deformity.

Between the two extremes just spoken of, *viz.*, between the Perfection of Form and Deformity, there is a wide interval in which neither the one nor the other predominates;—in which the Skeleton with its connecting Ligaments, and the various soft parts are perfect as regards their Functions, although not so accurately or finely developed or proportioned as they might be, or as they occasionally exist in individual instances.

In this interval between Beauty and Deformity we find the greater portion of Mankind and of the lower Animals, for which reason I designate it as the "Standard of *Ordinary* Healthy Development;" and I regard any departure from it, either as an ascension in the scale towards Beauty, or as a declension towards Deformity.

However accurate this description may be in principle, it does not correspond with the idea of Deformity necessary for our present purpose: it embraces too many and too minute degrees and stages of Form not in any way entering into the subject of these Lectures; and it therefore becomes necessary, before I proceed further, that I should state to you explicitly the precise meaning I attach to the term "Deformity;"—or, in other words, that I should give you a *Definition* of the *term*, which should strictly apply to, and include *all* the cases I am desirous of bringing before your notice.

By the term "Deformity" in this restricted sense, I mean an Original or an Acquired Deviation in the Skeleton from the Standard of its Ordinary Healthy Development previously described: its component parts being either altered in number;—in structure;—in shape;—in relative position;—or in the freedom of their movements over each other, so *as to modify and disfigure the external form of the Body;—or to interfere with the proper exercise of the functions of the part;—or with those of the part adjacent.* A Deformity therefore, in a Surgical sense, essentially consists in an imperfection of *Form*, or of *Motion*, frequently of *both* combined, *arising* from an alteration *in*, or an undue action *upon*, *the Skeleton.*

The Definition of Deformity which I have just given, fulfils other and much more important purposes besides that of merely explaining the restricted meaning of the term: it brings the whole subject at once under our observation, and directly and distinctly divides it Primarily into the following Four Divisions, *viz.*:—

1stly. The *Different Periods* at which its Causes begin to operate.

2ndly. The *System operated upon* by the Inducing Cause.

3rdly. The *Nature of the Deviation* produced by that Cause; and,

4thly. Although it does not specify the *Exciting Causes* themselves, it directly leads us to the discovery of their Nature:—consequently, it enables us, as from a starting point, to proceed methodically in our examination of the subject.

The FIRST DIVISION to which our attention is thus directed relates to the *Period* at which the Inducing Cause or Causes begin to operate, or, in other words, give rise to the Deformity. In the Examination of this point, the Definition affords us direct assistance, as it states that a Deformity is either an "*Original, or an Acquired Deviation in the Skeleton,*" *&c.* Thus it distinctly subdivides the whole subject, or Deformity generally, into two Groups, *viz.* :—1stly, into Deformities which essentially consist in an "*Original Deviation*" in the Skeleton, *i.e.*, in a Deviation of Form or of Motion in the Skeleton which has arisen during the *Development* of the Frame ;—or, 2ndly, into Deformities which consist of an "*Acquired*" Deviation, or, in other words, of a Deviation that has arisen *subsequently to the Normal Development* of the Body.

The Deformities which arise in the progress of the Development of the Body during Embryonic or Fœtal life[1] must obviously exist at the moment of birth, and the Child is, therefore, born with them, from which circumstance they are also designated "Congenital Deformities." As the term "Congenital" is more generally used in speaking of Deformities than the word "Original," moreover, as it perhaps expresses their Nature better, I shall henceforth substitute the one for the other, and thus avoid the confusion that would arise from the introduction of a new term.

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[1] Embryonic life embraces the first 4½ months of existence; the latter 4½ months constitute Fœtal life.

The Cases included in the second group are far more numerous than than those embraced in the preceding. They may occur at any period of life, and hence are well designated "Acquired Deformities." The term "Noncongenital" may, of course, be correctly applied to them; but I prefer the first term, as it conveys a more accurate idea of the nature of the case.

The subdivision of the subject into Congenital and Acquired Deformities will, perhaps, appear to many persons a trifling and useless distinction; but we shall hereafter see that it is very far from being so, and that our Prognosis in many cases will be very materially influenced by the consideration of the period of Origin which this subdivision marks out.

The Second Division brought under our consideration is *the System* operated *upon* by the Inducing Cause.

Whatever may be the nature of the Inducing Cause of Deformity, or period at which it exerts its influence, it must act either directly or indirectly upon the Osseous Framework itself. In some instances, as in the frightful Deformities produced by Rachitis, the Skeleton itself, or *Osseous System*, is undoubtedly the part primarily affected by the Inducing Cause, and the surrounding Systems are displaced and their Functions interfered with as the simple consequence of the primary affection of the Bones; in other cases, the Skeleton is perfectly developed, but the relative position of some of its parts is changed, and their movements interfered with by some force acting in an undue manner, consequently the Skeleton in these cases is only secondarily affected, as the Inducing Cause acts primarily upon some other System. Let us, therefore, inquire into the nature of those Systems which are capable of exercising such an influence.

In many of the Deformities produced by this secondary affection of the Skeleton, the Muscles will be found to be the parts primarily affected by the Inducing Cause ;—in others it will be the Fasciæ ;—in a third series it will be the Skin ;—and in a fourth the Ligaments ;—while in by far the greater number, two or more of these Systems will be found to be associated in producing the Deformity.

In whichever of the Systems just enumerated, *viz.*, the Muscles,—the Fasciæ,—the Teguments,—or Ligaments, the error lies, the Skeleton is acted upon purely mechanically, by a force having the power to draw its parts out of their Ordinary Position and Relation, and to retain them in such an Altered Position to the Injury of the others adjoining them ;—or, on the reverse, by failing to afford to the Skeleton that support which is their normal function, whereby the weight of the Body, or the action of Antagonistic Muscles, act injuriously upon it, and force one or more of its component parts out of their proper position.

The THIRD DIVISION of the subject draws our attention to "the Nature of the Deviation produced," or, in other words, to the Deformities themselves.

Although the Deviations in the Skeleton, which essentially constitute Deformities, vary exceedingly both in kind and degree, nevertheless the Definition accurately points out each variety, inasmuch as it informs us that the Deviation itself consists in either "an Alteration in the Number;—in the Structure;—in the Shape;—in the Relative Position;—or in the Freedom of the Movements of the component parts of the Skeleton, modifying External Form," &c., and consequently we have only to examine each of these subdivisions separately to ascertain with precision every variety of Deformity to which the Body is liable.

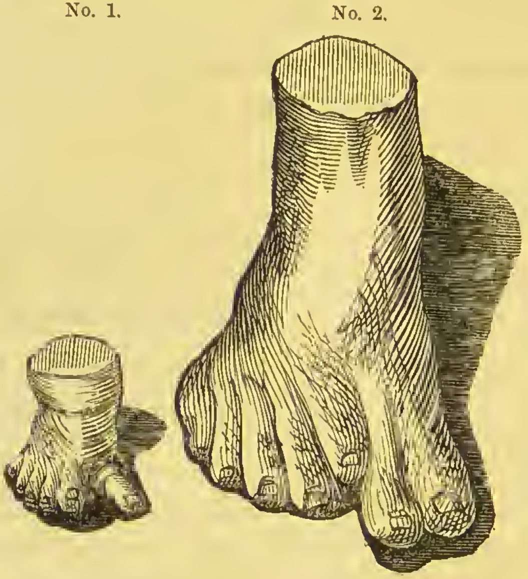
The First Deviation brought under our notice consists of an Alteration in the Number of the Bones composing the Skeleton; therefore, the abnormal condition must consist in either an Excess, or in a Deficiency of Parts, thus giving rise to two varieties of Deformities, *viz.*:—

Abnormity in Number, consists in either

- 1. Excess, or Redundancy of Parts.
    1. Of entire Portions of the Skeleton.
    2. Of one or more distinct Portions of a Member.
    3. Of Portions of a Bone.
    4. Of the Symmetrical Size of a Part.
- 2. Deficiency, or Absence of Parts.
    1. Of entire Portions of the Skeleton.
    2. Of one or more distinct Portions of a Member.
    3. Of Portions of a Bone.
    4. Of Symmetrical Size of a Part.

Of the above varieties of Deformities instances are of constant occurrence, and are doubtless familiar to most of you: for example, 1stly, Cases of Redundancy of entire Portions of the Skeleton, such as two Heads, four Arms, four Legs, &c., are seen in museums, and some of which I have referred to in the Second Lecture, see Nos. 139, 140, 141 of the Cases extracted from the Catalogue of the Museum of the Royal College of Surgeons of England;—or, 2ndly, Redundancy of one or more distinct Portions of a Member, as of the

Fingers,[2] as in a Case I have just seen, in which there are six perfect Fingers on each Hand ;—or, of the Toes, as seen in Diagram 1,[3] of six Toes ; and 2,[4] of



1. An Infant's Foot with Six Toes, and only Five Metatarsal Bones. The Great Toe was abnormal in size and position.

2. An Adult Foot with Seven Toes. The Great Toe and the one adjoining it are abnormal in size, but not in position.

N.B. These Diagrams are intentionally drawn in correct relative proportion.

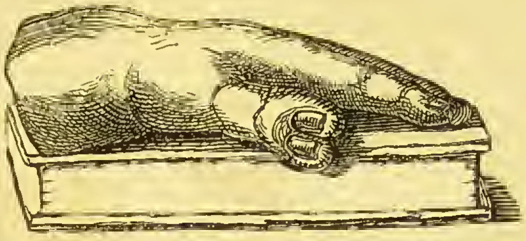
[2] I have recently removed from each Hand of an Infant a superfluous Little Finger. In this Case the Fingers were perfect, but as they had no articulation with the fifth Metacarpal Bone, they merely dangled from the side of the Head of the Fifth Metacarpal Bone.

[3] Within the last three years I have had two such cases—one a child, the other a youth of fourteen. In each case both Feet were deformed in the same manner. The first Metatarsal Bone was bifurcated at its distal extremity, and each bifurcation articulated with a Toe. The Inner or Great Toe in each Foot projected laterally inwards like the Thumb on the posterior extremity of the Gorilla or Chimpanzee, from which, however, it differed entirely anatomically, as it was not opposable to the other Toes. The Great Toes were abnormal both in size and position, and their projection was an effectual bar to the use of either boots or shoes. I, therefore, removed them by amputation, leaving the Feet both useful and sightly. The Outer and Lesser Toe, in each case, was the Superfluous Member, as shown by the fact that it possessed *three* phalanges, whereas the Inner and abnormally-enlarged Toe possessed but *two*, its normal number. See also No. 158 next Lecture.

[4] In this case, the Two Inner Toes are normal as to position ; but,

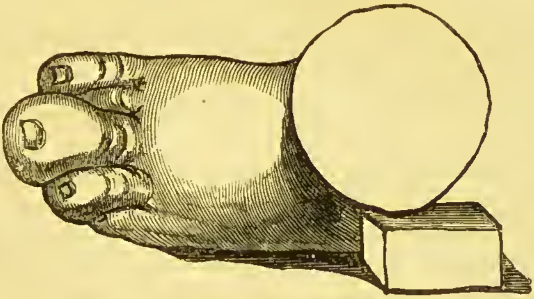
seven Toes, or, as in No. 158 of the Cases in Second Lecture, of eight Toes;—or, 3rdly, Redundancy of Portions of a Bone, as seen in Diagram 3 of a Bifid Thumb;[5]—or, 4thly, Redundancy of Symmetrical Size,[6]

No. 3.



3 A Child's Hand with the extreme phalanx of the Thumb Bifid, each bifurcation is terminated by a distinct nail.

No. 4.



4. A Child's Foot with Two Toes abnormal in Size. As these Toes continued to enlarge by growth disproportionately to the others, I considered it best to remove them by Amputation.

like the preceding, abnormal in Size. It is also evident, that they are articulated to a Bifid First Metatarsal Bone. It is also probable the Two next Toes are likewise articulated to a Bifid Metatarsal Bone.

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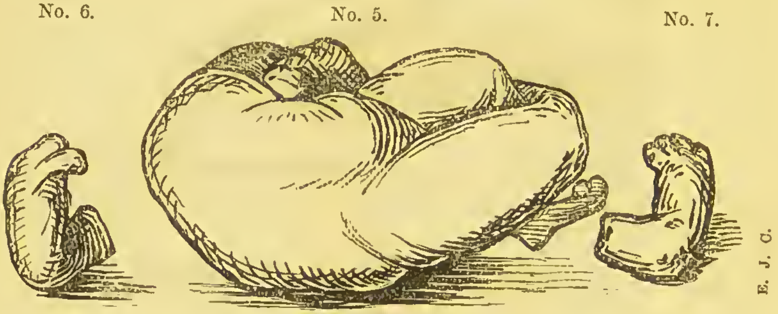
[5] There is a Cast in the Museum of the Royal College of Surgeons of a Man's Hand with a Double Thumb. There is only One Metacarpal Bone, which is bifurcated like the Metatarsal Bones in Nos. 1 and 2. The innermost Thumb is natural in Size, and it has only two (*i. e.*, its normal number) of phalanges; whereas the outer one is small in Size, and it has three phalanges like a Finger.

[6] A most interesting example of the same kind of Deformity, represented in Diagram 4, may be seen in the Cast-room of the Royal College of Surgeons. In this case the Cast is from the Foot of an Adult, and the two abnormal Toes, *viz.*, the second and third, which turn directly upwards, have become developed to at least twenty times the size of the adjoining fourth and fifth Toes, which remain normal

as in the abnormally-shaped Toes depicted in Diagram 4; —or, on the reverse, Cases of Deficiency of these Parts, such as an entire absence of distinct portions of the Skeleton,[7] as in Diagram 5, which is deficient of one-half of the Body,[8] and some of the Toes;—or, of one or more of



5. Copy of a Pen-and-Ink Sketch from my Note Book of a Human Monster born at the full time. For an account, see Note [8].
6. The Left Foot of the same Monster. It is drawn on a little larger scale to exhibit its Deficiency of Toes, of which it has but Two.
7. Do. do. the Right Foot. This Foot had only Four Toes.

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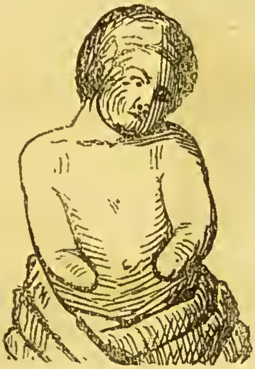
in Size and Length. There are also three Casts of abnormal development of particular Fingers. Two of these Casts were probably from the same person. The first and second Fingers on each Hand are abnormal in Size and Length. On the left Hand they are at least four times as thick and twice as long as the others, and curve laterally in opposite directions. On the right Hand the Middle Finger is the most enlarged; and although the first or Index Finger is enlarged, it is not nearly so much so as the middle one. These also curve laterally away from each other. The remaining Fingers were natural. The third case is also an example of Abnormity in Size and Length in the Index and Second Fingers. The Middle Finger in this Case is much larger than in either of the preceding Cases, and it is moreover curved laterally across the back of the Third and Little Fingers. The two enlarged Fingers are united the whole length of the first phalanx.

[7] See Cases Nos. 160 and 161, Second Lecture.

[8] The Human Monster, from which the sketch was taken, was presented by me to King's College Museum in 1836. It was born at the full time, and it was one of Twins. The other Child was perfect in Form, but it was covered all over with hair except the Face. The Mother attempted to explain the occurrence of such a Monstrosity by saying that about the sixth month of her pregnancy she was frightened by seeing a beggar in her garden. He had entered unobserved, and when she went into the garden, he was leaning over and into a barrel to get something out, so that she could see only one-half of his Body, and to this circumstance she attributed the birth of the above monster!!

the Limbs,[9] as in Nos 175, 176, 179, and 180, of the Cases referred to in pages 64 and 65;—or, of a Deficiency of a portion of a Member only, as in Diagram 8, representing the Congenital Deficiency of both Hands and part of the Fore-arms;—or, as in Diagram 9, of a like Deficiency of all the Fingers and Toes;—or, of one or more of the Fingers, as in Diagrams 10[10] and 14, each of which has only One Finger; and in Diagram 12, which has only Three Fingers; and in Diagram 13, which has only Four:—or, of the Toes, as in Diagram 11, which has but

No. 8.



8. Copy of a Pen-and-Ink Sketch from my Note Book of a Child born without Hands.

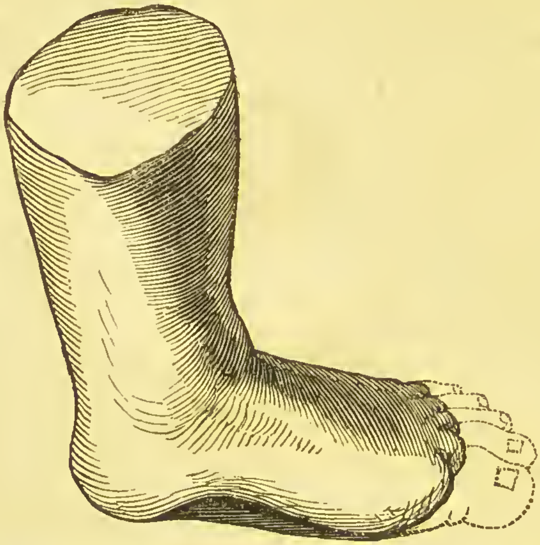
As the beggar was very rough, and had long hair, this was considered enough to account for the hairy condition of the Perfect Child.

[9] My friend Dr. Barnes (Physician to the Royal Maternity Charity), kindly afforded me the opportunity, about two years back, of examining a Child that was born with Both Arms deficient just below the Shoulder; and One Leg deficient from the upper third of the Thigh. The other Leg and Foot was diminutive and malformed. The Child was born at the full time, and lived a few weeks. It is now in the Museum of the Royal College of Surgeons. My colleague, Mr. Jonathan Hutchinson, has also just exhibited to me a drawing of a Child born without Arms or Legs. The Case, with a wood-cut, is published in the "Medical Gazette" of December 10, 1853. I have myself seen one Case of the same kind. There were only Nodules for Arms and Legs. There is also a Gentleman now living in Ireland, who was born without Arms or Legs. He is married and has fine well-formed Children.

[10] This was a most remarkable Case. On each Hand there was but

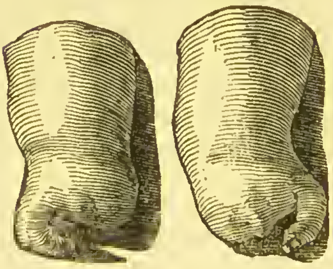
One Toe on each Foot; or in Diagram 6, which has Two Toes; or in Diagram 7, which has only Four. I have several other Casts lying by my side at this moment, in

No. 9.

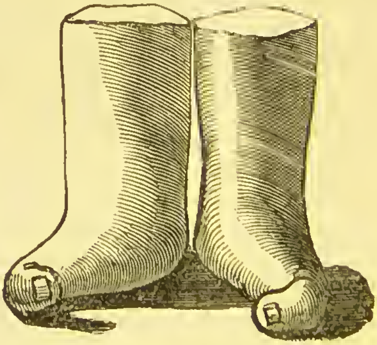


9. The Foot of a Child born without Toes on either Foot, or Fingers on either Hand. The protuberances in front are the heads of the Metatarsal Bones, and the dotted lines indicate the deficient Parts of each Toe. The Hands had similar Protuberances marking the heads of the Metacarpal Bones.

NO. 10.



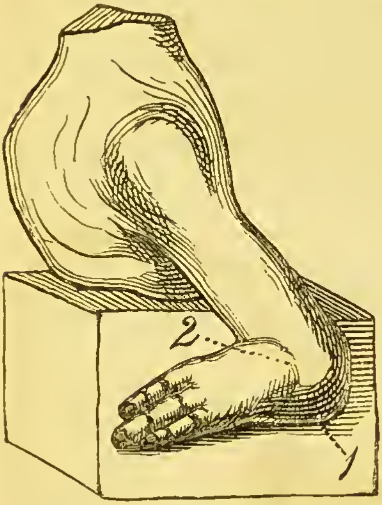
No. 11.



10. The dorsal surface of the Hands of a Child born with only One Finger (the Fourth or Little Finger) on each Hand; and One Toe (the Fifth or Little Toe) on each Foot. The Fingers flex laterally instead of on the palm.
11. The Feet of the same Child. See Note (10). The Toes flex laterally.

One Finger, which was well formed, but set laterally, as seen in Diagram 10. The Carpus and Metacarpus appeared to be natural, but the Thumb and Three Fingers were entirely absent. On each Foot which there are but Two Toes, and others in which there are only Three;—or, of an absence or imperfection of

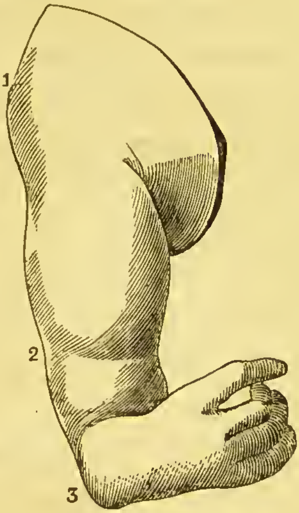
No. 2.



E. J. C.

1. Condyles of Humerus.
2. Carpus united to the Condyles.

No. 13.



E. J. C.

1. Head of the Humerus.
2. Olecranon.
3. Head of Ulna.

12. The Chest, Arm, and Hand of a Child born with a Deficiency of the Fore-arm, and a Contracted Wrist; the Hand wants a Finger and the Thumb. It is united to the Elbow. The Child was placed under my care for the Contracted Wrist.

13. The Arm of a Child also placed under my care for Contracted Wrist. The Radius and Ulna are Deficient of half their Normal Length.[11]

either of the other parts of the Skeleton, such as an entire absence of the Radius and Ulna, as seen in Diagram 12,[12] in which the entire Fore-arm is wanting, and the Hand is joined to the condyles of the Humerus at a right angle. In this case, also, the Hand

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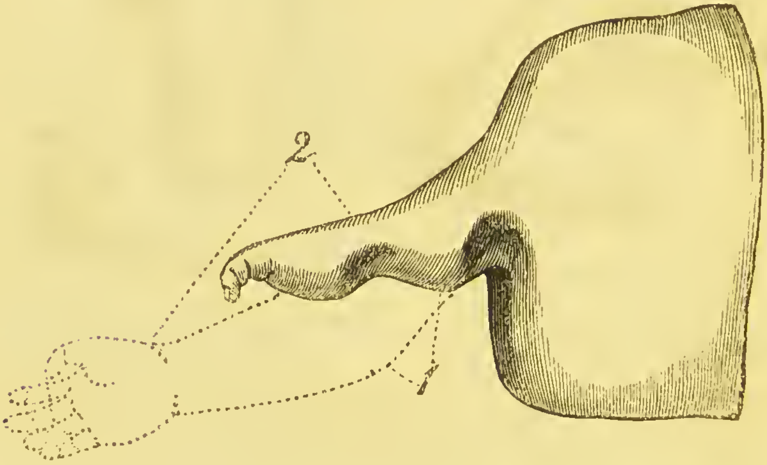
there was but One Toe (Diagram 11), *viz.*, the Little Toe, which is set laterally, so that the Child stands on the outer edge of the Toe; and the Metatarsus was deficient on the inner side, so that neither of the other Four Metatarsal Bones was possessed of its Normal Length.

[11] A copy of Cast No. 13, from which this was drawn, and also a Cast of the Case after treatment, with the Arm and Wrist straight, were given by me in 1852 to the Royal College of Surgeons, and are now in the Museum.

[12] See Case No. 177, p. 64.

wants the Thumb and One Finger;—or, or of an imperfection in their Development, whereby the Bone is deficient at one or the other extremity, as in Diagram 13, which represents the Arm of a Child, in which the Fore-arm is deficient of half of its normal length;—or, of a Deficiency of symmetrical or normal length simply, as in Diagram 14,[13] in which the Humerus is not more than one-half its normal length. This Diagram I have drawn from a cast taken by my friend and former pupil Dr. Ravenhill Pearce.

No. 14.



E. J. C.

14. The Shoulder, Arm, and Hand of a Child born with a Diminutive and Deformed Arm and Hand. The Humerus is only one-half its Normal Length; the Radius and Ulna are entirely wanting; the Hand is deficient of the greater part of the Carpal and Metacarpal Bones; and it has but One Finger which however is Normal in Size.
Fig. 1 indicates the situation of the Condyles of the Humerus.
Fig. 2 „ „ Carpus.

The Cases represented in the foregoing Diagrams demonstrate that each of the four varieties of Deformity arising from Deficiency may exist singly, or in combination with one or more of the other three, thereby giving rise to Deformities which vary in severity, from the most trifling Deficiency in the length of a member to the utmost distortion of Form or diminution of length the part is capable of admitting.

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[13] There is a full-grown fœtus in the Museum of the Royal College of Surgeons, the Arms and Legs of which are only a quarter of their Normal Length. The Feet and Hands are perfect. See also No. 181.

In illustration of the manner in which these varieties are blended the one with the other, let me draw your attention again to Diagrams 12, 13, and 14. In Diagram 12, there exists a total Deficiency of the Fore-arm, (Radius and Ulna,) as also of the Thumb and One of the Fingers, *i.e.*, of distinct portions of the Member. In Diagram 13, an examination of the Limb itself disclosed the fact, that the Radius was either altogether wanting or deficient below the Bicipital Tubercle;—that the Ulna was deficient of at least one-half of its Normal Length; as also that the Hand was deficient of the Thumb—it, therefore, presents us with an example of each of the three kinds of Deformity arising from Deficiency, *viz.*, 1stly, Deficiency of Entire Bones, *e.g.*, the Bone of the Thumb and Finger; 2ndly, of Deficiency of Portions of Bones, *e.g.*, the Radius; and, 3rdly, Simple Deficiency of Symmetrical Length, *e.g.*, of the Ulna, which does not correspond with its fellow of the opposite side, or with the Humerus, to which it is attached. Again, in Diagram 14, the Humerus is only one-half its Normal Length, and it is diminutive in Size; the Member is also deficient of the Fore-arm, and a great part of the Hand; and, excepting the Finger, the Hand is also diminutive in Size. The dotted lines representing the Arm and Hand, I have added in order to afford an idea of the amount each part is deficient in Size and in Length.

The Figures 1 and 2 refer to both the Cast and the supposed restored Parts; thus showing that the entire Fore-arm is deficient. This Case is, therefore, another example of the combination of the same varieties as Nos. 12 and 13.

The Deformities included in this division of our subject, *i.e.*, Excess or Deficiency in Bones, are, except simple Deficiency in Length, always Congenital;[14] and it is a curious fact, that you frequently find several Members of the same family similarly affected, from which circumstance they have been regarded as the result of Hereditary peculiarity.

The SECOND DEVIATION to which the definition draws our attention consists in "an Alteration *in the Structure* of one or more of the component parts of the Skeleton."

Alteration in the Structure of a Bone, whenever it has proceeded to a sufficient degree to give rise to a Deformity is usually accompanied by the THIRD DEVIATION pointed out by the definition, *viz.*, "Alteration in Shape," for which reason I shall at the present moment consider these Deviations conjointly.

Of all the Deviations of the Skeleton producing Deformity, "Alteration in Structure," with its attendant "Alteration in Shape," is the most frequent, while the Deformities produced by their combined agency are by far more numerous and severe than those arising from nearly all the other causes united together.

Of the correctness of the opinion just enunciated the most cursory inspection of any Museum, in which there are deposited the Skeletons and Casts of persons who during life had been afflicted with Deformity, will convince you; while at the same time it will introduce to your notice a more extended series of severe and complicated Cases than you were perhaps prepared to meet.

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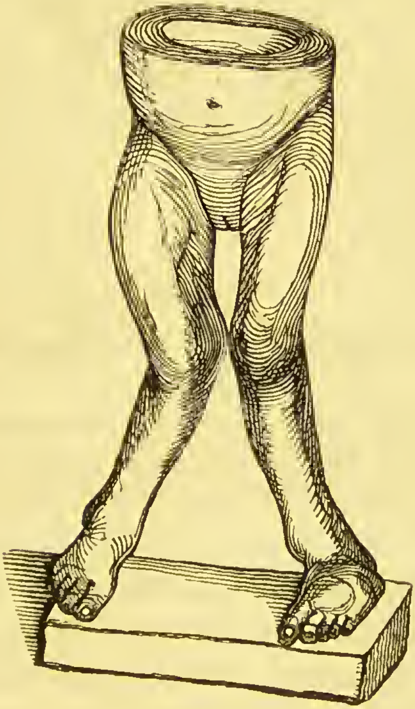
[14] Of course the loss of Limb resulting from violence or surgical operation is excluded.

Among the Cases which such an examination will bring under your observation, you will behold many

No. 15.



15. Anterior View of the Legs of a Rachitic Child. The Curvature of the Bones of the Thighs and Legs are well seen, as also the Divergence of the Feet and Enlargement of the Ankles.

varieties of Deformity caused by Rachitis[15] such as Curvatures of the Bones of the Limbs;—Enlargements of the Articular Extremities of the long Bones (Diagram 15);—Distortions of the Chest (Diagram 16), of the Pelvis, and of the Spine (Diagram 17);—as also Disproportionate and Irregular growth of the whole Skeleton;—or, again, you will discover a numerous class

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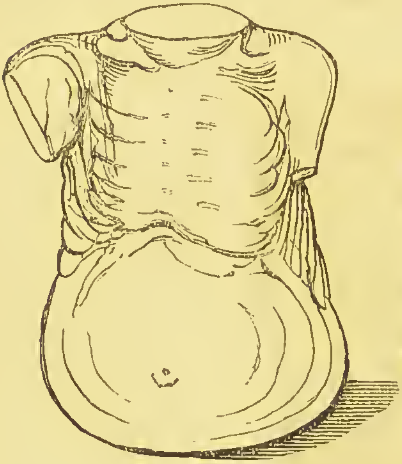
[15] For other Diagrams of these Cases, see Lecture V.

No. 16.



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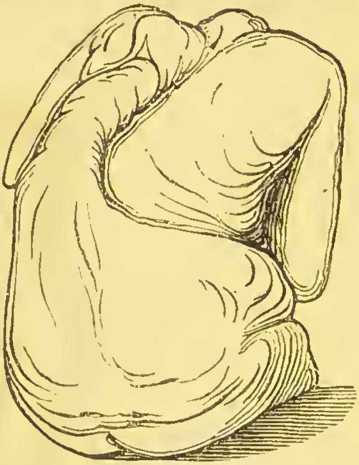


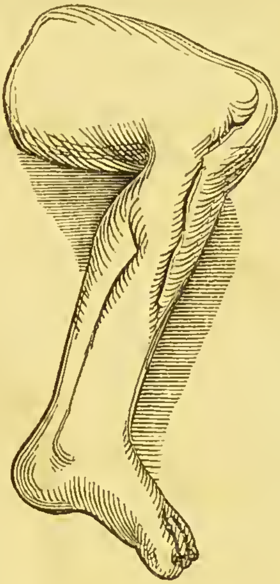
E. J. C.

16. Anterior View of the Body of a Rachitic Child, showing the Narrow or "Pigeon" Chest, the Tumid Abdomen, and Curved Clavicles.

17. Posterior View of the Body of a Rachitic Child, only eighteen months old, with severe Lateral Curvature. The Flattening and Falling-in of the Ribs on the Right Side, and the Curvature and Posterior Projection of the Angles of the Ribs on the Left Side, are well seen.

of Deformities that had been the result of the action of Scrofulous Disease, which from their very severity, and from the frightful Deformities produced, are painful to contemplate. Among these latter cases, you will observe numerous preparations illustrating the ravages of Caries of the Joints of the Limbs (Diagram 18), which had terminated in Anchylosis;—or, of the Vertebræ, in which body after body of the opposing Vertebræ had been removed by *Caries*, until, in some instances, as in Diagram 19, six, seven, or even more of the bodies of the Vertebræ had been partially or entirely destroyed, and their tissue, as well as that of the Intervertebral Substance removed, so that Vertebræ originally far apart had been brought into contact, left disconnected, or partially or perhaps entirely anchylosed together, according to the stage of the disease in which the patient had fallen a victim to its ravages ;—or confining your attention to those Cases in which the Spine as a whole had been affected without the supervention of Caries (Diagram 20), you will detect every variety and grade of possible Deformity arising from Curvature and Contortion, from the most simple Incipient Lateral Curvature in which the Spine had only begun to yield to the influence of the Inducing Cause, down to the severely Curved and Contorted Specimen, such as the Skeleton

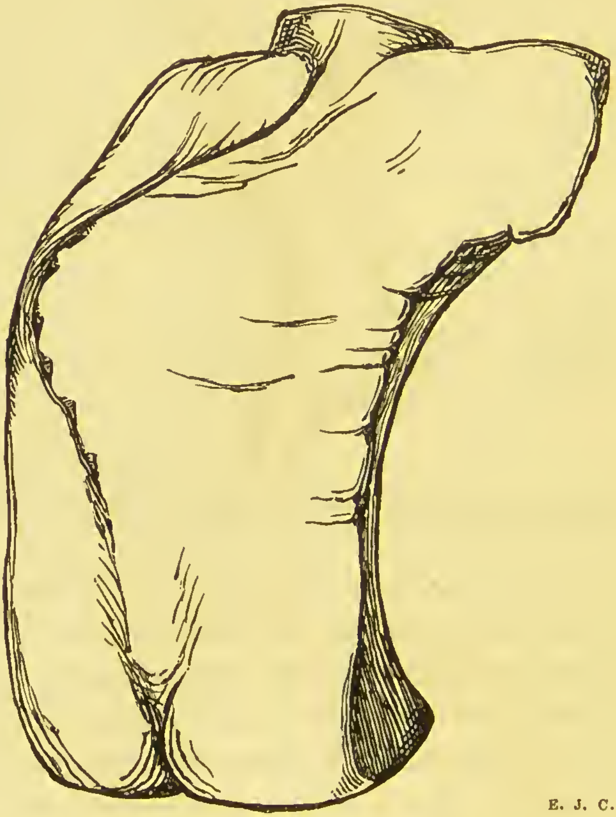
No. 18.



18. Contraction and Anchylosis of the Knee. The Cicatrices mark the Spots from whence Pus and probably Portions of Bone had been Discharged.

I now present to you (Diagram 21), in which the Spine had not only been bent into the shape of the letter **S**, but in which it had also been so Contorted by the Twisting or Rotation of the Vertebræ upon one another that the apices of the *transverse processes* of one side *present* themselves posteriorly in the mesial line, at the spot which ought to be occupied by the extremities of the *spinous processes*, thus giving rise to such frightful Deformity of the Spine, of the Chest, and

No. 19.



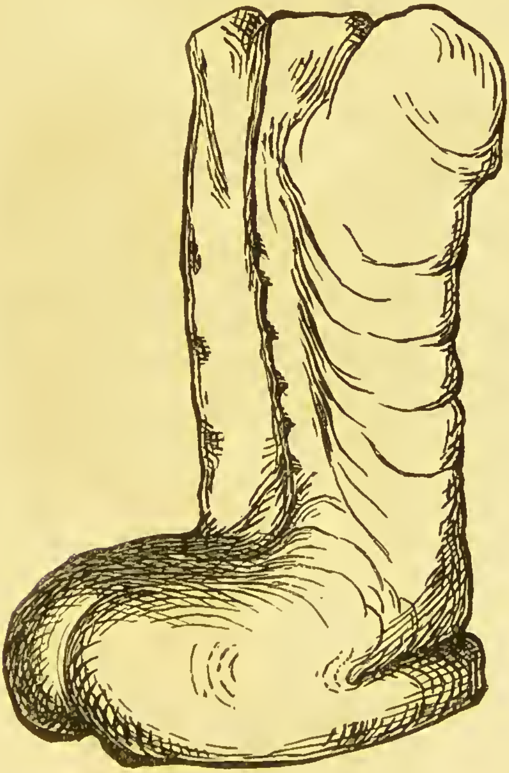
19. Sketch of a Youth's Back, who had suffered from Caries of the Spine. In all probability, the bodies of at least Six Vertebræ had been more or less destroyed.

of the Body generally, that you can but express your wonder that life could possibly have been supported under such unfavourable circumstances.

The Fourth Deviation pointed out by our definition consists in "An Alteration in *the Relative Position* of the Component Parts of the Skeleton."

In a state of health and in the absence of Deformity, the articulating surfaces of the bones entering into the

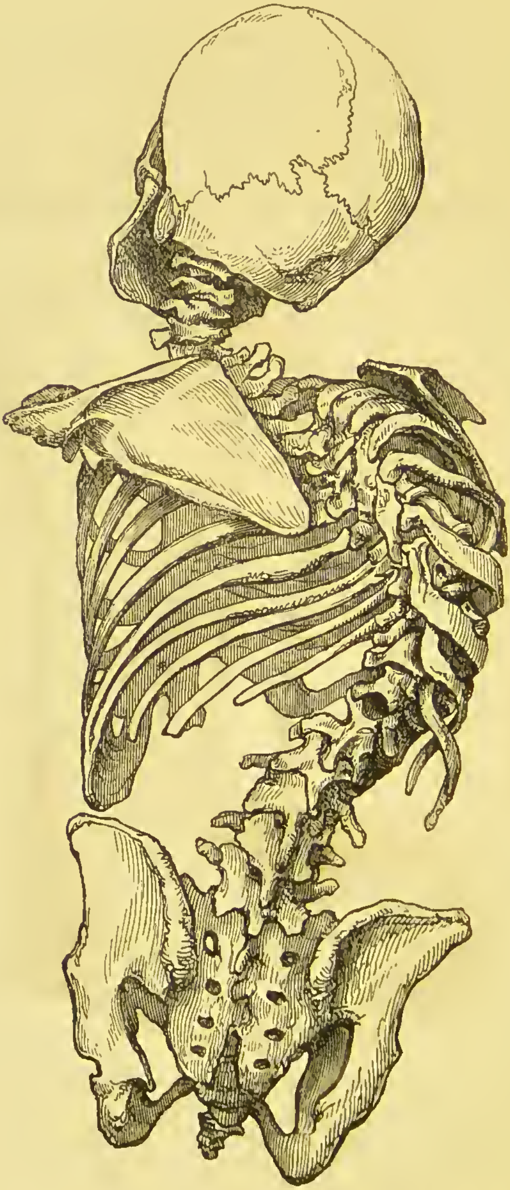
No. 20.



20. Sketch of the Back of a Young Lady, thirteen years old, exhibiting the most fearful form of Scrofulous Incurvation of the Spine that has ever come under my care. In this case, the lower part of the Abdomen could not be separated from the Thighs, neither in bed nor up. The only possible attitudes were sitting in a chair, reposing on the Side; or, on the Back with the Knees up to the Chest. A copy of this Cast was presented by me some years ago to the Museum of the King's College, London, in which it may be now seen; as also in the Museum of the City Orthopædic Hospital.

composition of a joint are free to move over one another to a given extent, according to the amount and kind of

No. 21.



21. Drawn from a Skeleton in my own possession. For Description, see Text.

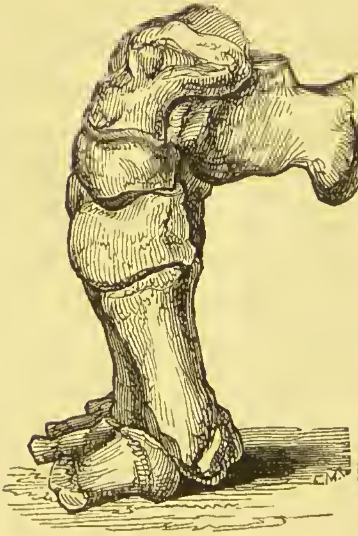
motion permitted in and peculiar to the individual joint: each part of the opposing articulating surfaces bearing in its turn an equal and proportionate amount of pressure, while no one part is either unduly exercised or liberated from the performance of its function. The regularity of action above described as proper to, and possessed by a perfect joint, is however occasionally so interfered with by some of the causes of Deformity to be hereafter considered, that the articulating surfaces are no longer free to move over one another to the full extent natural to the joint; nor do the normally opposed portions of the articulation bear an equal and proportionate amount of the pressure; but, on the contrary, the movements of the joint are greatly limited in extent and the naturally opposed surfaces of the articular cartilage are separated from each other, and in contact with other portions whose surfaces are not adapted to receive them, or to permit of the performance of the necessary movements of the joint with precision and firmness, in consequence of which the form of the entire limb is impaired, the joint itself more or less disfigured, its parts retained in an unnatural position, and its freedom of movement and its functions generally interfered with to such an extent that the limb is rendered comparatively useless.

As Osteological preparations illustrating the alteration in the relative position and configurations of the bones and their articular surfaces, to which I have alluded in the preceding observations, are comparatively rare, I consider myself fortunate in being able to introduce to your notice a specimen (Diagram 22), which clearly demonstrates the whole of these changes.

The preparation consists of the Bones of the Right Foot of a person who had during life suffered from a severe form of Club Foot (Talipes Equinus).

In this preparation you will observe that the entire Foot is bent upon itself at right angles at the articulations between the Os Calcis and the Os Astragalus, and the Os Calcis and the Os Cuboides, in consequence of which the projecting process of the Os Calcis which supports the anterior articulating surface for

No. 22.



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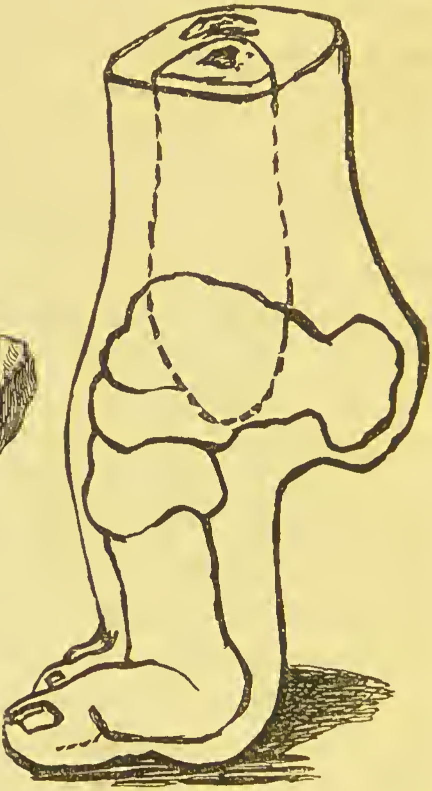

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22. Drawing of the Bones of an Adult's Foot, who had suffered from Talipes Equinus. For Description, see Text.

23. Diagram representing the Bones, depicted in No. 22, clothed by the Muscles, &c., *i. e.*, as the Foot would have appeared during life.

the Astragalus, is brought into actual contact with the posterior inferior edge of the Scaphoid, thus precisely taking the place of the Calcaneo Scaphoid Ligament, which Ligament as you are aware, in the normal skeleton, is partially covered with Synovial Membrane on its upper surface, and supports the rounded head of the Astragalus. In this particular, therefore, the Astragalus had a bony articulation at its inferior and internal part, instead of a smooth and somewhat yielding arch of ligamentous structure.

Upon directing our attention to the individual bones, we find by far the majority of them had undergone an absolute change of form, the peculiarities of which I will endeavour to point out to you.

The Os Calcis at first sight appears to be but little changed in its form, yet upon closer inspection you will observe that the articular surface for the Os Cuboides is directed obliquely downwards and backwards, instead of perpendicularly downwards, a change in direction to correspond with the abnormal angle at which they are articulated together; while at the upper part of the articular surface, there is situated an unnatural overhanging crest which would have afforded a very serious obstacle to the restoration of the joint into a proper position had the case been subjected to treatment.

The proofs of the existence of an altered relative position in the Os Calcis, are, however, much more numerous than I have mentioned, for independent of its approximation and attachment to the Scaphoid previously noticed, we find it almost in contact with the upper extremity of the fifth Metatarsal Bone; and upon its upper surface we observe an adventitous cartilaginous facet, which it is quite evident had abnormally articulated with the Tibia.

Proceeding to the next bone, *viz.*, the Astragalus, we find it greatly modified in its general form, and its articulating surfaces changed, both in shape and direction;—for example, the upper articulating surface, *viz.*, that for the Tibia, is evidently situated more posteriorly than it ought to be, and it is diminished in its size by a portion equivalent to the false articulating facet observed upon the Os Calcis: while the anterior articulating surface, for the Scaphoid, looks directly downwards instead of forwards, and is supported on a neck which is both thickened and curved downwards in a corresponding direction.

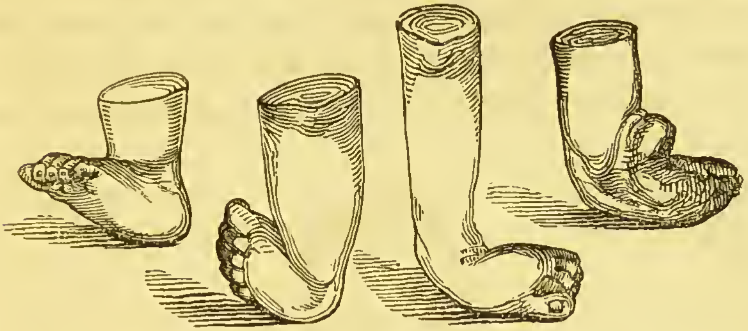
The Cuboid Bone is absent;—it is, however, evident that it had undergone a considerable modification in its form.

The Scaphoid and Cuneiform Bones may be regarded as natural, with the exception of the posterior surface of the Scaphoid, which is to articulate with the altered anterior articulating surface of the Astragalus.

Passing from the Tarsas to the Metatarso Phalangeal articulations, we there observe that the head of each of the Metatarsal Bones has its articulating surface carried much farther back than usual, and that each articulating surface is surmounted by a thick Crest, which juts against a corresponding Crest developed upon the upper part of each of the first Phalanges.

The Deformities brought under our notice by this (the FOURTH) DEVIATION are numerous. They consist of the different kinds of Clubfoot (Diagrams 24, 25, 26, and 27), with the exception of the most simple and

No. 26. No. 24. No. 25. No. 27.



24, 25, 26, and 27.—Diagrams representing the four chief varieties of Club Foot—

24. Anterior View of the Left Foot of a Child with severe Congenital Talipes Equino Varus. The only part of the Foot that could touch the ground when standing was the *outer* edge near the Ankle.

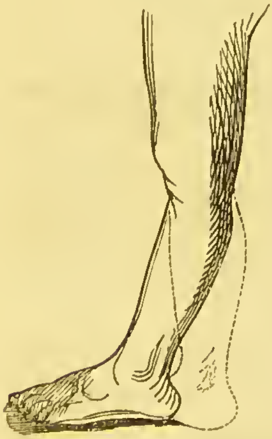
25. Anterior View of the Left Foot of a Child with severe Congenital Talipes Valgus. The only part of the Foot that could touch the ground when standing was the *inner* edge.

26. A Side View of the Left Foot of a Child with Congenital Talipes Calcaneus. The only part of the Foot that could touch the ground when standing was the *Heel.*

27. A Side View of the Left Foot of an Adult with a severe form of Non-congenital Talipes Equinus. The only part of the Foot that could touch the ground when standing was the *dorsal surface* of the Tarsus, Metatarsus, and Toes. For a *Congenital* Case, see Diagram 22 or 32. In these cases *only* the Toes touch the ground when standing.

incipient forms which belong to the next subdivision;

No. 28.



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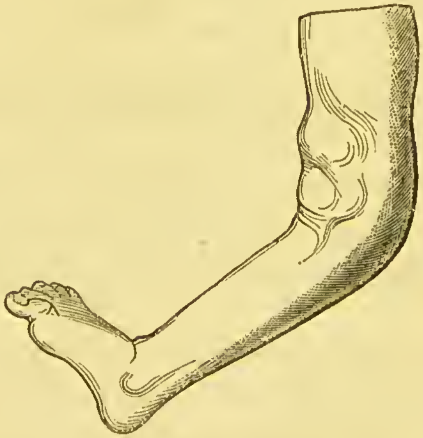
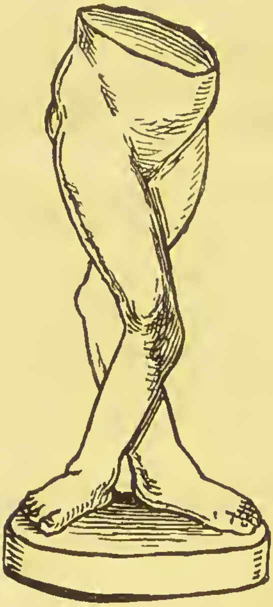


28. Drawing from a Cast of a Child's Leg, in which the Leg bends abnormally anteriorly. The dotted lines, which represent the normal position of the Leg when standing, have been added, to show the extent of the abnormal flexion forwards.

29. Drawing of a Man's Leg similarly but more severely deformed.

—Misplacements of the Bones of other parts, as of the Knee (Diagrams 28 and 29), in which the Tibia is misplaced antero posteriorly, so that the Leg can be flexed abnormally forward, as well as in its normal direction;—or, laterally, as in the various degrees of Knock Knees (Diagrams 15 and 30);—or of Misplacement of the Bones of the Hand, an example of which affecting the Fingers may be seen in Diagram 31.

No. 30.



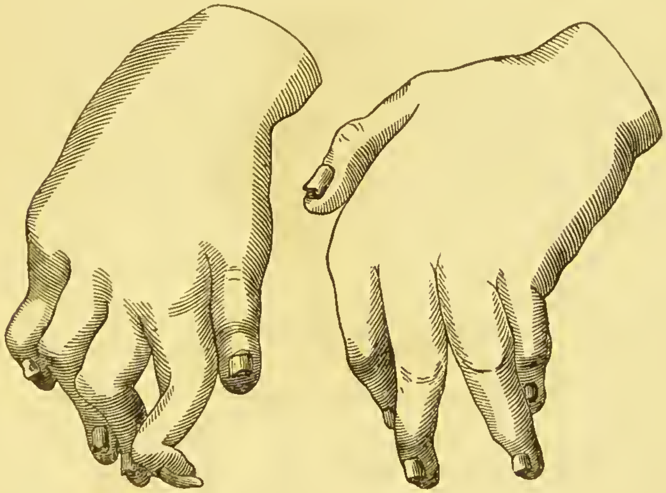
30. Sketch of a Child's Legs with severe Knock Knees. In standing, the Child supported herself by crossing the Knees, and resting the one against the other.

The Alteration in the Freedom of Motion and Interference with the Functions generally of a Joint alluded to in the previous subdivision, as the inseparable attendant upon "altered relative position of the bones," exists in many instances alone, in which case it constitutes the

Fifth and Last Deviation that I have to bring under your notice.

In most instances the two last deviations coexist, the less severe affection being the invariable and inseparable attendant upon the greater; but it must be borne in mind, that in others the last deviation, *viz.*, Impaired Freedom of Motion, exists alone, in which case the joint is simply retained in some perfectly *natural* position between flexion and extension, without the least apparent external deformity. Diagram 32, taken from the cast of one of my patients with club foot (Talipes Equinus), will illustrate the class of cases included in this subdivision. In this case the patient was simply unable to bend the Ankle so as to put the Heel to the ground. In every other respect the Foot was quite natural.

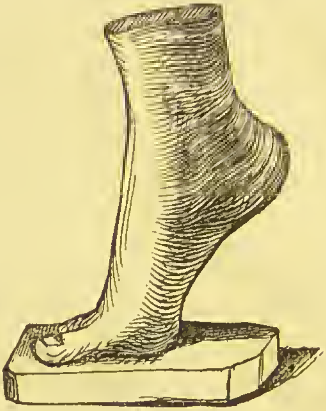
No. 31.



31. Sketch of the Hands of a Man, deformed by Rheumatism. At the time I saw him, he was unable to bend either the Hip, Knee, Ankle, Toe, Shoulder, Elbow, or Wrist, and the Fingers but little. For further history, see Lecture VI., on Rheumatic Deformities.

In all these cases it will be found, upon examination with the hand, that the Bones are correct in Form and Relative Position, but that the power of motion in the joint is interfered with, to a greater or less extent; consequently, the cases themselves consist of Impaired Motion simply, and vary in intensity from the most trifling impediment to free motion down to the greatest possible state of Flexion, Extension, Abduction, or Adduction, or of their combined movements which the Joint will admit of without forcing the *bones* into an *unnatural* position.

No. 32.



32. Drawing of a Youth's Foot with Talipes Equinus.

As an exemplification of one of the more simple forms just spoken of, I may mention a case that I have under my care at the present moment (1852). My patient is a fine grown Child, about five years of age, whose Feet, if you saw him standing, you would pronounce perfectly formed, and whose power to walk you would not for a moment doubt, as his Legs are well developed and muscular: yet, upon the Child's attempting to walk, he stumbles or falls to the ground at every second or third step, in consequence of an inability to Flex the Foot upon the Leg sufficiently for the purpose of raising the Toes from the ground during the act of progression.

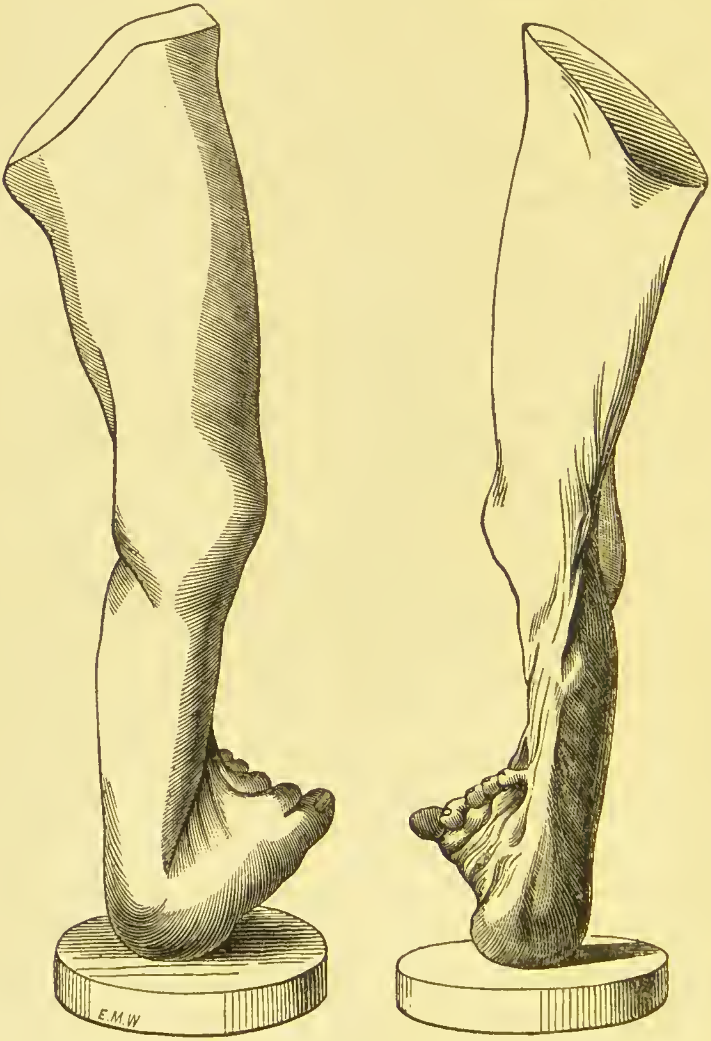
The effect of this inability to Flex the Foot upon the Leg is, to cause the Toes to be constantly projected against the ground at the distance of half a step forward; whereby it requires the greatest effort on the Child's part to prevent his falling to the ground, which effort, even when successful, gives rise to an awkward stumbling gait.

The Error in the above case, therefore, consists simply of Impaired Freedom of Movement, the motion of Flexion in the Ankle Joints being limited to about one half of its proper amount;—or, in other words, the Foot cannot be Flexed upon the Leg beyond a right angle, which is *not* sufficient for *walking*.

As many of the Causes which give rise to the Deformities included in this subdivision are of a severe nature, and of continued action, we frequently see cases passing gradually from this section into that of the one above it: for example, the effect of a Severe Burn or Scald in the neighbourhood of a Joint is to form a Cicatrix or Band, which, by its Contraction, gradually diminishes the extent of motion belonging to the part. Now, while the action of the Cicatrix is confined to the production of Flexion or Extension, &c., *within the natural limits* of motion belonging to the joint, the case is strictly one which appertains to the Fifth Deviation; but if the contraction of the Cicatrix proceeds beyond that point, and the articulating surfaces become *abnormally removed from one another*, the case then belongs to the previous section.

In illustration of the distinction between the cases resulting from simple "Impaired Freedom of Move-

No. 33. No. 34



E. J. C.

33 Front and 34 Back View of a Cast of the Foot and Leg of a Lad, aged 11, who had been severely Burnt in Infancy. This Foot could have been replaced, but the Lad considered it of too great value to him to permit me to do so, as he obtained his livelihood by showing it. For a Descripsion, see Text.

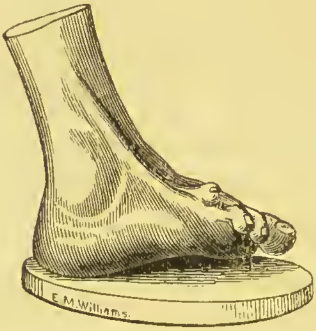
ment," and of "Altered Relative Position of the Bones," I would draw your attention to the cast upon the table

(Diagrams 33 and 34) of a most singular and interesting variety of Deformity.

The patient had during childhood received a severe Burn down the posterior part of the Thigh, and on the outer and back part of the Leg and Foot, as a consequence of which each of those parts had become the seat of severe Cicatrices.

If we confine our attention to the Knee Joint, the Deformity there produced belongs strictly to the Fifth Subdivision, inasmuch as the only injury to that joint is an interruption to its perfect extension, occasioned by the Cicatrix at the back of the articulation; but, if you direct your attention to the Foot, you will instantly observe, that the Deformity there produced belongs to the previous subdivision, for the whole foot is so unnaturally contracted, and *its bones so absolutely displaced*, that the outer-edge of the Foot is drawn up and united to the outer side of the Leg in such a manner that the little Toe is situated nearly midway between the outer Ankle and the Knee Joint. In this case the Foot had been gradually and forcibly drawn up from its normal position (in childhood the Boy had a perfect Foot) by the gradual contraction of the dense bands of Cicatrices (as seen in Diagram 34) until the whole of the plantar surface of the Foot was raised from the ground, and the weight of the Body in progression transferred from the sole of the Foot to the inner Ankle. This case altogether presents such an extraordinary degree and variety of Deformity that, had I narrated it without being able to produce the Cast, you would have hardly believed it possible that the Bones of the Foot of a Child that had once walked naturally, could be so displaced by force of any kind. That it is possible, the Cast before you is a demonstrative proof; and it is most satisfactory that it is in my power to exhibit to you the Cast of another case of the like Deformity in the course of Deformation (Diagram 35), thus exhibiting the mode of its production. In this case, as in the former, the Deformity is the result of the gradual and powerful contraction of the Cicatrix following a Burn. The Cicatrix extends from the under-surface of the two outer Toes up the side of the Foot to the middle of the outside of the Leg. It has already forcibly drawn the outer side of the Foot so much upwards that the inner edge of the Foot alone looks towards the ground. The Sole is turned obliquely outwards, exposing the under-surface of the Toes, and the Foot is flexed upon the Leg so that the Toes cannot touch the ground. It is, therefore, precisely similar to No. 33, and, if permitted to go on, will doubtless produce a Deformity identical in character and severity.

No. 35.

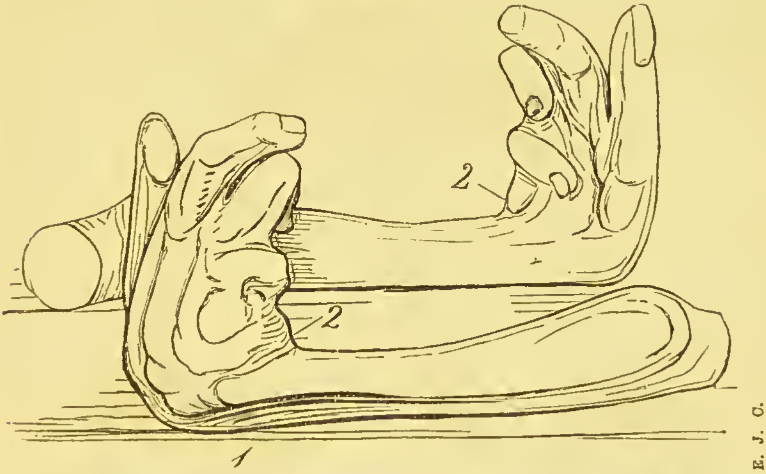


E. J. C.

35. Drawing from a Cast of the Foot of a Lad who had been Burnt. One Toe was destroyed.

Since this Lecture was in type, I have become possessed of the Hand and Arm of a Man, who, at some period of his life, had suffered from a severe Burn or Scald on the Hand and Fore-arm up to the Elbow, which accident had given rise to as severe a Deformity of the Wrist and Hand, from Contraction and Union of Parts not normally united, as exists in the Ankle and Foot in No. 33. According to my own experience, these Cases (33 and 36) are each unique of its kind;—indeed, Contraction could not possibly go further (see Diagram 36), as the Little Finger and *inner Side* *of the Hand* are drawn up close to, and united by a band of Cicatrix, to the *inner Edge of the Arm*, thereby retaining the Hand in a precisely similar position *to the Arm* that the Foot occupies with regard *to the Leg* in No. 33. In this Case, also, the Little Finger had lost Two of the Phalanges by the injury, like No. 35, which has lost the Phalanges of the Little Toe.

Nos. 36 and 37.

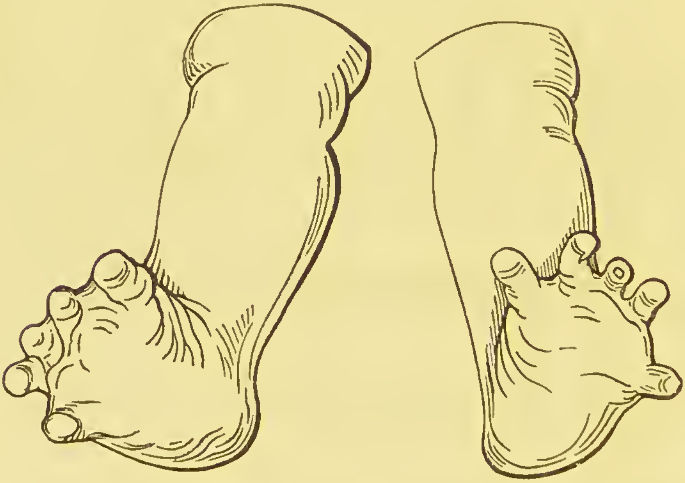


36 View of Dorsal, and 37 of Palmar Surface of a Hand contracted by the Cicatrix of a Burn. The Man had died from Phthisis, and hence the Emaciation.
1, The Head of the Ulna.
2, Cicatrix uniting inner edge of Hand and Arm.

I have met with one, *and only one* Case, in which the Deformity consisted of *exalted action in the Muscles* of the Feet and Leg, and *increased extent of Movement* in the Articulations both of the Ankle and Toes.

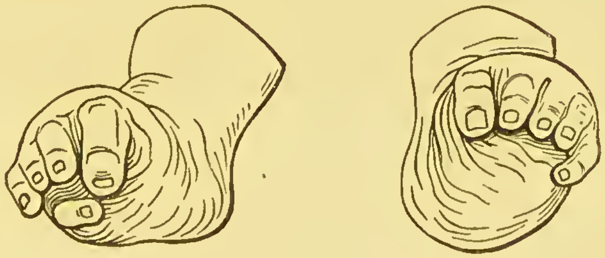
The Case admitted of no treatment;—indeed the Members might be said to be too perfect, for they were capable of performing, not only the functions of Feet, but, to a great extent, of Hands also; in fact they were endowed with an absolutely prehensile power. As this Case, also, according to my own experience, is unique, I subjoin sketches of both Feet, from which it will be readily apparent that they were possessed of extraordinary power. (See Diagrams 38 and 39.)

No. 38. No. 39.



38 and 39. Outline Drawing of the Feet of a Child who possessed prehensile powers in the Toes. The Feet are placed on the Leg and abducted, and the Toes extended ready to grasp.

At the Ankle Joint the Motions of Flexion, Extension, Abduction, and Adduction were so perfect and *extensive in range*, and the Muscles so exalted in action, that the varied Movements were made with a rapidity and certainty that does not belong to a Normal Foot;—for example, the Dorsum of the Foot could be instantly drawn up close to the Leg (as seen in Diagram 41), and then struck out rapidly, so as to seize with the Toes any object required; while the Movements of Abduction and Adduction were equally perfect and abnormally extensive (see Diagrams 38 and 39). The Toes were abnormally separated from each other, especially the First and Second; and Fourth and Fifth (as seen in Diagrams 38 and 39), and the Articular Surfaces of the Heads of the First and Fifth Metatarsal Bones, were situated more laterally than usual, in consequence of which the Great and Little Toes projected on each side as if they were Thumbs; and when fully Flexed, their Extremities nearly met across the Sole of the Foot (as seen in Diagram 40). The power of Flexion of the Toes on the Sole of the Foot was also greater, and more under the control of the will than I have ever before seen possessed by any other Human Being (see Diagrams 40 and 41).



No. 40. No. 41.

E. J. C.

40 and 41. Outline Drawing of the Feet of the same Child (as in Diagrams 38 and 39) with the Toes firmly grasped together. In the Right Foot it will be seen that the Great and Little Toe just meet on the Sole of the Foot.

The Fourth and Last Division will be considered in the next Lecture.

SYNOPSIS OF LECTURE II.

Consideration of the Fourth Division, *viz.*, The Nature of the Inducing Cause—Arrangement of the Causes inducing Congenital Deformities, according to the period at which they exert their influence;—1stly, On the Ovum;—2ndly, On the Embryo;—and, 3rdly, On the Fœtus—Consideration of the 1st Cause acting upon the Ovum, *viz.*, Error in the Primary Impulse of Development, or, Originally existing in the Ovum—Effect of Impregnation on the Ovum—Requisites for Development in the Class Aves—Proof of the Occasional Existence of Error in the Primary Impulse of Development, or in the Ovum, in this Class—Proof of the occasional existence of the same Error, 1stly, in other Classes of the Inferior Animals;—2ndly, in the Vegetable Kingdom;—and, 3rdly, in Man—Consideration of the 2nd Cause acting upon the Ovum, *viz.*, Hereditary Influence—Proofs of the Existence of such a Cause—Kinds of Deformity which result therefrom—Inferences to be drawn from the Occurrence of Deformity from the Action of this Cause, 1stly, on the Father's side;—2ndly, on the Mother's.

LECTURE II.

ON THE CAUSES INDUCING CONGENITAL DEFORMITIES.

Although the Definition which I gave in the previous Lecture does not include or explain the Causes by which Deformities are occasioned, it, nevertheless, furnishes us with the direct means of ascertaining most, if not all, of them; inasmuch as we have only to examine each of the Divisions, and each of the specified Deviations by the aid of the sciences of Physiology and Pathology, to determine with accuracy their Inducing Cause.

The Cases included under the First Primary Group, *viz.*, "Congenital Deformities," exist at the moment of birth, and therefore the deviations constituting them must have been produced by Causes capable of acting upon either the Ovum, the Embryo, or the Fœtus, *i.e.*, during development; and, consequently, we have now to enquire physiologically and pathologically for an explanation of the Nature of the Causes which are capable of exerting an influence upon them.

The Causes that have been assigned as capable of exerting such an influence are various; some persons especially dwelling upon one variety, while others, with equal confidence, refer them to another. We will, therefore, endeavour to institute an enquiry into the Nature and Value of each of them; for which purpose I have arranged them in the order set forth in the following table:—

The Causes of Bodily Deformity exert their Influence,

- 1. Before Birth (Congenital Deformity), and appertain,
  - 1. To the Ovum.
    - Error in the Primary Impulse of Development, or Originally existing in the Ovum.
    - Hereditary Influence.
    - Mental emotion of Mother during Pregnancy.
  - 2. To the Embryo.
    - Arrest of Development.
    - Mechanical Injury; or, Interference with the Movements of Embryo.
  - 3. To the Fœtus.
    - Mechanical Injury; or, Interference with the Movements of Fœtus.
    - Disease acting *directly* or *indirectly* on the Skeleton, as below.
- 2. After Birth (Acquired Deformity), and appertain,
  - 1. To the Child;
  - 2. To the Adult;
  - and they act in each of these periods, either
    - 1. Directly on the Skeleton.
      - Disease.
        - 1. Rickets.
        - 2. Scrofula.
    - 2. Indirectly on the Skeleton.
      - 1. Disease, or Error in the Exciting Cause of Muscular Action.
        - 1. Excess or Spasm.
        - 2. Deficiency or Paralysis.
      - 2. Disease, or Error in the Muscle itself.
        - 1. Inflammation.
        - 2. Disease.
        - 3. Abscess.
        - 4. Sloughing.
        - 5. Wounds.
      - 3. Mechanical Impediments.
        - 1. Contraction of Skin.
        - 2. „ of Fasciæ.
        - 3. „ of Ligaments.
      - 4. Deficient Support.
        - 1. Relaxation of Fasciæ.
        - 2. „ of Ligaments.

In arranging the foregoing Table it will be observed that I have included both "Congenital" and "Acquired" Deformities, and that I have so placed the various-assigned Causes, in the order in which they exert their influence, 1stly, upon the Ovum;—2ndly, upon the Embryo;—3rdly, upon the Fœtus;—4thly, on the Child, and, lastly, on the Adult: but I must here remark, that the first specified Cause appertaining to the Ovum, *viz.*, "*Error in the Primary Impulse of Development, or Originally existing in the Ovum*, has never, to my knowledge[16] (1852), been advanced as a Cause of Deformity by any other person than myself; and it is, therefore, with some considerable diffidence that I adduce before you the evidence upon which I seek to establish its claim to be considered such.

Whatever the change may be which takes place in the Ovum at the moment of Impregnation, it is certain that a power or principle of life is imparted to it which it did not possess previously, and without which power or principle, the Ovum, when once discharged from the Ovary although anatomically perfect,[17] as for as our senses, aided even by the microscope, enable us to judge of it, does not even possess the power to resist the external agencies leading to immediate decomposition, much less the power to become imbued with life as a separate being.

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[16] This Lecture was delivered at the City Orthopædic Hospital, March 20, 1852, and the Synopsis was published antecedently. I append this remark because I find there is now just published (1861) a book by Dr. P. L. Panum, Professor der Physiologie in der Universität zu Kiel, entitled "Untersuchungen über die Entstehung der Missbildungen zunächst in den Eiern der Vögel."

[17] "In very young Animals (Man and the Mammiferous Animals), *even in the Embryo*, as it approaches Maturity, we can discover *Ova in the Ovaria*, furnished with a *Germinal Vesicle* as they are at any other subsequent period of life; the *Vitellus* is, indeed much smaller, and so is the Graafian Vesicle, the contents of which appear to consist of larger cells, and occupy much less space than in ripe Ova (Fig. xi). The Ovum, with all its *Essential Elements*, however, is there, and in

That the condition of an *un*impregnated Ovum is as above described, any person accustomed to keep Fowls can testify of his own experience, as the domestic Hen will frequently lay a series of Eggs, although she has been kept in a situation in which it has not been possible for them to have become impregnated. The same thing also occurs frequently with caged Hen Canary Birds; and it is stated by Naturalists, that it occurs likewise among Reptiles and Fishes. The Eggs deposited under these circumstances are, to all appearances, internally and externally exactly like those which are perfect, *i.e.*, impregnated, and, among Birds, the Hen will sit upon them; but all her efforts are *ineffective*, as the Eggs quickly decompose.[18]

The formation and liberation of *un*impregnated Ova is, however, not confined to the Oviparous Animals, as

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existence at birth." [The Italics in this Note are by me.—E. J. C.]—*Wagner's Elements of Phys.*, by R. Willis, p. 50.——Also, "The addition of Seminal Fluid to the Egg makes no immediate perceptible alteration in its structure or appearance."—*Allen Thomson*, *Art. Generation*, *Cyclo. of Anat. and Phys.*, p. 434, vol. 2.

[18] "Spallanzani opened very many Female Frogs at the time of propagation, but before they had laid any spawn, and, consequently before impregnation could have occurred, and he satisfied himself that the ripest Ova extracted from the Oviduct and placed in water gradually passed into putrefaction without undergoing any of the changes of Development, while some of the same Ova, upon which he had sprinkled some of the Seminal Fluid taken from the Body of the Male and placed in similar vessels of water, had Tadpoles formed from them in the same manner exactly as those which were fecundated by the Male Frog itself."—*Allen Thomson*, ibid. p. 436.

it is well known that among Viviparous Animals, Ova are liberated from the Ovary at regular periods,[19] although the Female has never had intercourse with the Male. In like manner, in the vegetable kingdom, among Diœceous Plants, the Ovules are produced on one (the Female) Plant, and, if not fecundated by the Pollen of another[20] (the Male) Plant, are soon cast off and decay.

In the Virgin Human Female no exemption exists from the general law affecting the lower Animals, as Ova are ripened at *every* catamenial period, and extruded from the Ovary, leaving the Graafian Follicles as distinct Cicatrices, and yellow spots termed Corpora Lutea, behind them on the surface of the Ovary, thereby indicating the spots from whence the Ova were discharged.[21] The Ova thus liberated, like the Eggs of the Hen, and the Ova of the preceding examples, are devoid of the principle of life, and consequently, like the latter, are quickly decomposed.

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[19] "It is familiarly known and admitted, that among the lower Animals Graafian Vesicles very generally burst, and, of course, shed their contents, towards the end of the period of heat, whether they have had connexion with the Male or not. So long ago as the year 1672, the celebrated Kerkring (*Phil. Trans.*, 1672) maintained that Ova were occasionally, at least, discharged from the Ovary of the Human Female during the Menstrual period," &c.—*Wagner's Elements of Phys.*, Note by Dr. Willis, p. 69: London, 1841.

[20] A most interesting example of this is afforded by the Aucuba Japonica, which is so common in our gardens. A Pistilliferous (Female) Plant was introduced into this country in 1783, and has been propagated ever since by cuttings. The Stamineous (Male) Plant has however, at last, been sent here by Robert Fortune, Esq., from Japan, and was exhibited at the opening of the Royal Horticultural Society, South Kensington, in June last (1861). The Date Palm and the Pistacia Nut are also interesting examples. Of the first, Burnett says, "The Date Palms being diæcious (*i. e.*, the Stamens and Pistils being not only in separate Flowers, but growing on different Trees), the Crops entirely fail, or the Fruit is degenerate and unfit for Food, if unseasonable Weather, or any Accident should prevent the Pollen of the Stamineous Plants having access to the Flowers of the fruit-bearing ones. To ensure the Fertilization of the Seeds, the Arabs have long been accustomed to gather the Stamineous Clusters and hang them over the Pistilliferous Flowers, and even to lay up stores of Pollen from year to year. At the season when this is done a feast is held, called 'The Marriage of the Palms,' of which Hazel-

The perfect or *impregnated* Egg, on the contrary, possesses a power of resisting the effect of the external agencies conducive to decomposition for some considerable time,[22] which power of resistance of decomposition, we may call the latent principle of life, or life asleep, to arouse which into activity nothing more is necessary than air and a certain degree of warmth (100° to 104° Fah.) continued for a determinate time (in the Hen's Egg twenty-one days) whereupon the fluid Egg becomes gradually converted into the solid living Chick.

The nature of the impulse of Development impressed upon the Ovum by Impregnation, by the influence of which its constituent molecules arrange themselves

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quist has given a very interesting account." . . . . And of the latter, Loudon remarks, "The Pistacia Officinalis abounds in Sicily, where it is cultivated for its Nuts. * * * * The Male puts forth its Flowers first, and some Gardeners pluck them whilst yet shut, dry them, and afterwards sprinkle the Pollen over the Female Tree. * * * * This operation is called *Tuchiarare*, and never fails to produce fructification."—See *Burnett's Outlines of Botany*, vol. i. p. 309; and *J. C. Loudon's Encycl. of Plants* (1829), p. 833.

[21] Dr. J. Power on "Periodic Discharges in the Human Female." 1832.

[22] Instances have been recorded of the Eggs of the Hen having been kept from twelve to fourteen months and afterwards hatched.

into definite forms, so that the Ovum of every description of Animal always brings forth a creature in Form, Structure, &c., similar to the Parent Animal from which the Ovum proceeded, *is*, and doubtless *ever will be* an inscrutable mystery, it is therefore futile to attempt to enquire into it; not so, however, the enquiry whether there is anything like proof that that *impulse* is occasionally abnormal in its character; or, that the *Ovum* originally developed in the Female preparatory for Impregnation, is *imperfectly endowed*, as this enquiry is both practicable and useful.

In Birds, the ova *after* fecundation, *i.e.*, after the impulse of Development is imparted to them, are perfected as "Eggs" within the Body of the Female, or, in other words, the *Germ* in each Ovum is furnished with the supply of concentrated Pabulum (the yolk and albumen) requisite for the nourishment of the fœtal Bird, and for the Development of its tissues; they are then covered with calcareous matter (the Shell) as a protection, and extruded from the Body in appropriate situations; some in nests skilfully constructed, others in mere depressions on the surface of the earth;—some to be hatched by the warmth of the Parent Bird, others by the warmth of strangers;—while in yet a third series, the Eggs are either simply deposited in the sand, or, in nests formed of sand and leaves,[23] and left to be hatched by the heat of the sun, &c.;—and, lastly,

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[23] "FAMILY MEGAPODIDÆ.—The Genera Talegalla, Loipoa, and Megapodus form part of a great family of Birds inhabiting Australia, New Guinea, Celebes, and the Philippine Islands, whose habits and economy are most singular, and differ from those of every other group of Birds which now exist upon the surface of our globe. . . . . . The

Man, seizing upon the hints thus afforded by nature herself, has ingeniously contrived the means to hatch the Eggs of Birds, which naturally are hatched by the Parent Bird.

The variety in the mode in which the Eggs of Birds may be hatched is, however, a matter that only interests us at the present moment, from its demonstrating the fact that the agency of the *Parent Bird* is not absolutely required for the Development of the Ova, and

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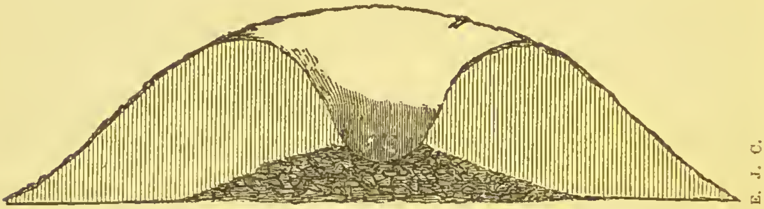
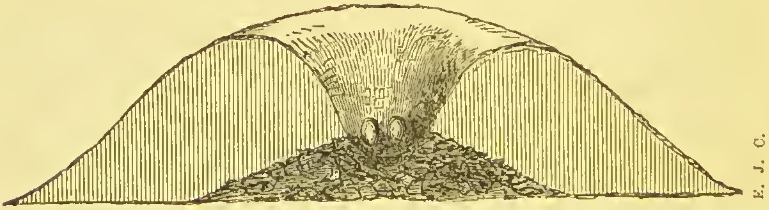
Three Species of the Family inhabiting Australia, although referable to Three distinct Genera, have many habits in common, particularly in their mode of Nidification. Each and all Deposit their Eggs in Mounds (Diagrams 42 and 43) of Earth and Leaves, which becoming heated either by Fermentation of the Vegetable Matter, or by the Sun's rays, form a kind of Natural Hatching Apparatus, from which the Young at length emerge fully feathered, and capable of sustaining life by their own unaided efforts." . . . . .

No. 42.



42. Section of the Nest in its undisturbed state. The pale tint indicates the portion of Sand ; and the darker tints, the Leaves, &c.

No. 43.



43. Section of the Nest with the Sand cleared out to show the Eggs.

"In the Genus Leipoa, the Mounds are from 12 to 13 yards in circumference, and from 2 to 3 feet high: the general Form is that from its thus affording us the positive proof that the impulse of Development imparted to it by Impregnation, or that the properties residing in the Ovum itself, *is something separate and apart from the vital energies of the Parent Bird;* and the laws by which the Development is regulated after the Egg is once extruded from the Body can be in no way dependent upon, or modified by, the state of the nervous system, of alarm, or of imagination, if *you* can imagine such a state, in a Bird, or even by the death of the Bird itself.

As the source from which the requisite warmth is

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of a Dome.—The Sand and Grass is sometimes scratched up for a distance of from 15 to 16 feet from its outer edge.—When an Egg is to be deposited, the top is laid open, and a hole scratched in its centre to within 2 or 3 inches of the bottom of the Dried Leaves. The Egg is placed in the Sand just at the edge of the hole in a Vertical Position, with the smaller end downwards.—The Sand is then thrown in again, and the Mound left in its original form. —The Male Bird assists the Female in opening and covering up the Mound.—Eight is the greatest number of Eggs I have heard of, from good authority, as having been found in One Nest."

"THE GENUS MEGAPODUS.—Mr. G. R. GRAY informs me that the Females of some Species associate together in Bands during the Night, and deposit their Eggs in a cavity, which they dig to the depth of 2 or 3 feet; and the successive deposits of Eggs amount to 100 or more, and are left to be Hatched by the Solar rays; that some cover them with Sand, and others with the remains of Plants; that the Eggs are extremely large for the size of the Bird, and are generally of a cinnamon colour."

"One Mound was 8 feet high, 77 round."

"The Eggs were 3½ inches high, by 2½ broad, and 6½ feet deep from the nearest surface."

"There are Two in the Zoological Garden—a Male and a Female."—*The Birds of Australia, by John Gould, F.R.S, in Seven Vols. Vol. I.* Introduction, p. lxxiii.

obtained to hatch the Egg, no matter whether the source be natural; for example, from the Bird that deposited the Egg, or from a strange Bird—or artificial, as from the Sun, &c., can exert no influence whatever upon the Form or Size of the Creature developed, it necessarily follows that if in any of these cases Development is *im*perfect, that such *imperfection* must be the pure result of an *Error in the Primary Impulse communicated by Impregnation; i. e.*, that it was the result of an impulse of Development which was abnormal in its character;—or, of an Imperfection in the *Ovum itself*, as developed in the Female *before* Impregnation, and therefore, as Imperfection, Deformity, and even Monstrosity, can be proved to exist in the Young of Birds sufficiently often for our museums to be supplied with numerous examples, it incontestibly establishes the fact that the *Primary Impulse* of *Development communicated to the Egg at the period of Impregnation is sometimes Abnormal—or that the Ovum itself was Imperfect;* consequently, this proof of Abnormity in the class of Birds,[24] enables us to understand the part which the impulse of Development performs in Mammiferous Animals, as well as in the Human Being; in all of which Classes reproduction is affected by the agency of Ova, as much as it is in the Bird, with this sole difference, that in each of these classes the impregnated Ovum is conveyed into an *internal nest* (the

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[24] In Snakes the Ova are deposited in appropriate places; *e.g.*, The Sunny Bank of a Dry Ditch—a Dunghill, &c., and Hatched by the Warmth of the Season, &c. In these, *as in Birds*, we have instances of Deformity; for example, a Snake with 2 Heads (see page 56, No. 31 and 32), and, therefore, the Error and Abnormity must have been independent of the Parent as in Birds. Also in Frogs, see No. 70.

Uterus),[25] and is there provided with the requisite *warmth* and *nourishment* necessary for its Development; whereas in the Bird, and in the Oviparous Animals generally, the Ovum with the requisite supply of Pabulum is packed up in the Shell, as it were in a Box, and extruded from the Body, the supply of warmth requisite to arouse its sleeping energies of life into action being furnished by external agencies, the supply of nourishment being contained within itself.

That the *Ovum* itself is sometimes *Abnormal*, or that an *Abnormal Impulse*[26] of Development is sometimes communicated to the Ovum *at Impregnation*, in the class of Birds, I need only refer to the *proofs* existing in the Museum of the Royal College of Surgeons of England.

As it is at this time so especially important for me to establish beyond a doubt the existence of this Abnormity or Error in the Ovum ;—or in the Primary

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[25] In the Surinam Toad a kind of false Uterus, or External Nest, is formed on the Back of the Female. " Lorsque les Œufs sont pendus, le Male les place sur le dos de la Femelle et les y féconde de sa laite ; alors la Femelle se rend a l'eau, la peau de son dos se gonfle, et ferme des cellules dans lesquelles les Œufs éclesent. Les petits y passent leur état de têtard, et n'en sortent qu'après avoir perdu leur queue et développé leurs pattes. C'est là l'épegne eù la Mère revient à terre."—*Le Règne Animal, par M. Le Baron Cuvier*, vol. i. p. 428. *Les Pipa.*

[26] There is a most striking remark appertaining to this point (Error in the Impulse of Development) made by Dr. Carpenter, in his Works, p. 536, it runs thus :—" It appears from Mr. Newport's ingenious experiments, that the contact of a Single Spermatozoon is not adequate to produce complete Fecundation, but that the penetration of a certain Member of Spermatozoa is requisite; and he has ascertained that Fecundation may be effected *partially* (so as to occasion *some*, though not all, of the Normal changes in the Ovum) by a smaller amount."

Impulse of Development *in Birds*, I shall beg your attention to the following Selected List of absolute proofs of such Abnormity from the College Catalogue of Monstrosities, the first seven of which, it will be noticed, are all absolute instances of Abnormity in the Egg itself (see Diagrams 44, 45, 49, 50, and 51).

A. *Abnormity in the Structure of the* OVUM *of the* BIRD.

No.		No. in Catal. of the Museum of the R. C. of S.
1	A Domestic Fowl's Egg[27] with 2 Yolks	221
2	A ditto ditto	222
3	A ditto ditto, joined by a small pedicle	223
4	A ditto ditto ditto	224
5	A Malformed Hen's Egg	225
6	A ditto ditto	226
7	A Small Egg, spherical in form and covered by its proper shell. It was found enclosed within another perfect Egg	227

B. *Monstrosity or Deformity in* BIRDS *from Addition of Parts.*

8	A Duck with 1 Body, 2 Heads, and 2 Necks	30
9	A Fowl with 2 Heads conjoined, 3 Eyes	179
10	A Head of a Bird with 3 Mandibles	274
11	A Chick with 2 Heads conjoined, 4 Legs, 4 Wings	181
12	A Guinea Fowl with 2 Heads conjoined	180
13	A Chick with 1 Body, 4 Legs, and 4 Wings	41
14	A Fœtal Acephalous Duck, 1 Body, 4 Wings	315
15	A Chick with 1 Head, 2 Bodies, 4 Legs, and 4 Wings	40
16	A Chick with 4 Legs	42, 43, and 44
17	A Duck with 4 Legs	46
18	A Pigeon with 4 Wings	47
19	A Gosling with 3 Legs	45
20	A Lark with a 3rd Leg	288
21	A Duck with a Leg growing from the Head	31
22	A Hedge Sparrow with a Bifid Beak	67
23	A Duck with a Leg growing from the Head—*Museum Drawings.*	
24	A Fowl with an additional Toe	28
25	A ditto ditto	289

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[27] I have just been informed that Mr. P. Thomson, Egg Merchant, Borough, possesses a Fowl's Egg with 3 Yolks.

C. *Monstrosity or Deformity in* BIRDS *from Deficiency of Parts.*

No.		No. in Museum Catal. of R. C. S.
26	A Fœtal Acephalous Duck	315
27	A Chick Hatched with only 1 Leg	123
28	The Skeleton of a Pigeon Hatched with only 1 Leg	311
29	A Fowl that never had Feathers, 7 Months old	122

It is, however, not only in the class of Birds that instances of imperfect, deformed, or even monstrous Development can be adduced, inasmuch as such cases are well known to exist in the other classes of Oviparous Animals; for example, in the Snake (see Nos. 31, 32, and 33);—in the Dog-Fish (No. 34);—in the Frog (Nos. 70 and 126);—and in the Lizard (No. 80), *all of which* are as *positive* instances and *proofs* of Abnormity in the Ovum, or of Imperfection in the Primary Impulse of Development, as those occurring in the Bird; inasmuch as, like the Bird, they were developed *out of the Body* of the Parent. In every other class in the Animal Kingdom each individual is developed from an Ovum as much as in the Bird, or other Oviparous Animal; and it is reasonable to assume that Development is governed in each by the same laws: therefore, if in *these* classes Deformities or Monstrosities of the *like* kind which occur in Birds, &c., are found to exist, it is a *presumptive* proof that such Deformities and Monstrosities arise from a *like* Cause. I shall, therefore, adduce the proof, that such Deformities and Monstrosities do exist not only in the various classes of the Animal Kingdom, but also in the Vegetable, in which latter Kingdom each individual is produced from a Seed or Germ equivalent to the Ovum, which Seed, like the Ovum, possesses the principle of Life *apart from*, and *independent of*, the Plant from which it proceeded.

Monstrosity or Deformity in ANIMALS *resulting from the Addition of Parts.*

No.		No. in Museum Catal. of R. C. S.
	A. Two Heads, Two Bodies, both Conjoined	
30	2 Twin Fœtal Lambs, Heads and Bodies united to Umbilicus, One of the Heads a Cyclops	316
	B. Two Heads on One Body—Entire or Partial.	
31	A Snake with 2 Heads	32
32	A ditto ditto	33
33	A Drawing of a ditto ditto captured in 1761—*Museum Drawings.*	
34	A Dog Fish with 2 Heads	34
35	A Double-Headed Calf, Heads conjoined at Occiput	172
36	A ditto Lamb	268
37	A Pig with 2 Mouths, 2 Tongues, and 2 Sets of Teeth	172
38	A do. with 2 Defective Heads conjoined, 2 Mouths, 2 Snouts, 3 Eyes	173
39	A Calf's Head, 2 Mouths, 2 Noses, 3 Eyes	17
40	A Cat, the anterior part of Head Duplex	26
	C. Two Bodies with only One Head—Entire or Partial.	
41	A Pig with One Perfect Head, 2 Bodies, and 8 Extremities	197
42	A ditto ditto with Bodies conjoined	198
43	A ditto ditto ditto	199
44	A ditto ditto ditto	200
45	A ditto ditto ditto, Rudiments of a 2nd Head	201
46	A ditto ditto ditto ditto	202
47	A Puppy with One Head, 2 Bodies, 4 Posterior Extremities, only 2 Anterior	203
48	A Cat ditto ditto	204
49	A ditto ditto ditto	205
50	A ditto ditto 2 Bodies conjoined	206
51	A ditto ditto ditto ditto	207
52	A Kitten with 1 Head and 2 Bodies	212
53	A ditto ditto ditto	213
54	A ditto ditto ditto	214
55	A ditto ditto ditto	215
56	A ditto ditto ditto	216
57	A ditto ditto ditto	217
58	A ditto ditto ditto	218
59	A Rabbit with do. ditto	219
60	A Mole ditto ditto	200
61	An Earth Worm (Lumbricus terrestris) with 2 Bodies	5

D. Two Heads, Two Bodies more or less Conjoined.

No.		No. in Museum Catal. of R. C. S.
62	Twin Fœtal Puppies, united by Abdomen and Thorax, 2 Monoculous Heads conjoined	178

E. Additional Extremities.

63	A Kitten with 8 Extremities	208
64	A ditto ditto	209
65	A ditto ditto	210
66	A ditto ditto	211

F. Three Posterior Extremities.

67	A Dog with 3 Posterior Extremities	176
68	The Pelvis of a Monkey with Rudiment of a 3 ditto	279
69	Ditto Sheep with a Posterior Extremity growing from Pubis	281
70	A Frog with 3 Hind Legs	49

G. Three Anterior Extremities.

71	A Cow with a 3rd Fore Leg	282
72	A ditto ditto	283

H. Additional Foot.

73	A Double Foot of a Pig (Sus domesticus)	285
74	The Right Fore Foot of a Pig with a Supernumerary Foot attached to the Carpus	286

I. Additional Toes.

75	The Foot of a Pig with an Additional Posterior Toe	38
76	The ditto ditto ditto	287

K. Additional Horns.

77	A Cow's Head with 3 Horns	271
78	A Supernumerary Horn of a Cow	272
79	A ditto ditto Goat	273

L. Additional Tails.

80	A Lizard (Lacerta Strumosa) with 2 Tails	48
81	An Earth Worm with 2 Tails (or Bodies)	50

No.		No. in Museum Catal. of R. C. S.
	2. Monstrosity or Deformity in* ANIMALS, *the Result of a Deficiency of Parts.	
	A. Deficiency of the Head, Part or Entire.	
82	A Pig, Part of the Head Deficient	170
83	A ditto ditto	81
84	A ditto, the Lower Jaw Deficient	79
85	A Puppy with Part of the Head Deficient	177
86	A Kitten ditto	85
87	A ditto ditto	86
88	A Carp ditto	91
89	A Lamb ditto	69
90	A ditto ditto	71
91	The Skull of a Fœtal Acephalous Lamb	302
	B. Deficiency of Trunk and Extremities, or Portions of ditto.	
92	A Fœtal Pig, the Posterior Part of the Body is Defective, the Extremities are Diminutive and Solid-ungulous	117
	C. Deficiency of Anterior and Posterior Extremities, or Parts of ditto.	
[28]93	A Dog, all 4 Legs like Feet alone	111
94	A ditto ditto	112
	D. Deficiency of Eye.	
95	The Skull of a Monoculous (Cyclops) Lamb	303
96	A Monoculous Lamb (Cyclops)	73
97	A ditto ditto	75
98	A ditto ditto	76
99	A ditto ditto	77
100	A ditto ditto	316
101	A ditto ditto	84
102	A ditto Pig	84
108	A ditto ditto	169

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[28] See Human Deformities, No. 181, p. 64; and Note 13, p. 18.

No.		No. in Museum Catal. of R. C S.
104	A Monoculous Cat	
105	A ditto ditto	88
106	A ditto Pig, with a Proboscis, or Prolonged Snout from above the Eyes	160
107	A Similar Elephant Pig, ditto ditto	161
108	A ditto ditto	162
109	A ditto ditto	163
110	A ditto ditto	164
111	A ditto ditto	165
112	A ditto ditto	166
113	A ditto ditto	167
114	A ditto ditto	168
115	A ditto ditto	169
116	A ditto ditto	170
117	A ditto ditto	171
118	A ditto Dog	174
119	A ditto Cat	175

E. Deficiency of Jaw.

120	The Head of a Red Deer, Lower Jaw Deficient	304
121	The Skull of a Calf ditto	305
122	A Lamb, Upper Jaw Deficient	316

F. Deficiency of Posterior Extremity.

123	A Boar with only 1 Hind Leg	114

G. Deficiency of Anterior Extremity.

124	A Cat, Born without Anterior Extremities	109
125	A Dog ditto ditto	110
126	A Frog ditto the Right Anterior Extremity	124

H. Deficiency of Toes.

127	The Right Foot of a Pig, 1 Toe Deficient	115
128	The Left Foot of a Pig ditto	116
129	A Pig's Foot, Solidungulous	117
130	A ditto Toes Connate	118
131	A ditto ditto	119
132	A ditto ditto	120

I. Deficiency of Hair.

133	A Mouse (Mus Musculus) which never had Hair	121

No.		No. in Museum Catal. of R. C. S.
	K. Deficiency of Feathers.	
134	A Fowl that never had Feathers (7 Months old) ...	122
	L. Imperfection of Parts.	
135	2 Elephant's Tusks, Connate in their whole Length	266
136	A Star Fish with 2 of its Rays Connate	125

In the List which I have just read you will observe there are instances of Deformity in each of the following classes of Animals, *viz.*, *Annelidæ*, *Pisces*, *Reptilia*, *Aves*, and *Mammalia;* and in another section of the Catalogue we find eight instances of irregularity in development in the *Vegetable Kingdom*, consisting of preparations of double Apples, double Cucumbers, a double Bean, a bifid Fern-leaf (Asplinium Scolopendrium, the leaf (or botanically the *frond*) of which is simple and undivided), a wild Hyacinth with double blossoms, and a Peach, one half of which resembles a Nectarine, the other half being natural ;—to which list I can add, from my own observation, instances of connate stems or branches, two, three, or more being united and enclosed within the same bark, as seen frequently in the Ash. Petaloid bractæ, stamens or pistils ;—petals remaining in part like leaves ;—and of blossoms growing out of the centre of other blossoms as frequently seen in the Rose : from all which cases of irregularity, united to those previously given among Animals, I think you will admit that I have advanced a presumptive proof that error occasionally exists in the impulse of development, or in the Ovum itself, in both the Animal and the Vegetable Kingdom.

As the cases that I have hitherto cited have been selected from either the inferior Animals or from Plants,[29] I am now desirous of drawing your attention to the proof of the existence of *precisely the same kind* of Deformities and Monstrosities derived from the Human Being.

The first point to which I wish to direct your attention in support of such an opinion, is the fact of the existence of preparations in the Museum of the Royal College of Surgeons of England of Human Monstrosities and Deformities in *every respect equivalent to*, and in many instances *identical* with those I have brought before you in the Animal Kingdom. The preparations are numerous, and I shall therefore only make a selection :—

No.		No. in Museum Catal. of R. C. S.
	1. *Monstrosity or Deformity in the* HUMAN BEING *arising from the Addition of Parts.*	
	A. One Fœtus contained within the Body of a Child.	
137	A Female Fœtus found in the Abdomen of Thomas Lane, who lived to be Fifteen Years Old, June 19, 1814. In this Fœtus the Left Upper Extremity had only 3 Fingers, with very long Nails; and upon 1 Foot 6 Toes	7
138	A Male Fœtus found in the Abdomen of John Hare, a Child between Nine and Ten Months Old. In this case the Fœtus had on 1 Foot 8 Toes, and the Great Toe was Split into 2 smaller well-shapen Toes with Nails; and the Foot on the Left Leg "is misshapen in the manner of a Club Foot," and "the Great Toe projects considerably outwards "like a Thumb separated from the Fingers" ...	8

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[29] By the side of the road leading from Crawley to Staplefield, a Stem of a very large Tree was pointed out to me, which, about 2 Feet from the Ground, divided into 2 Trunks—the one of which was *an Oak* Tree, the other *a Beech*. It measures at least 7 Yards round the Stem.—1852. I myself gathered and brought home a Branch from each.

No.		No. in Museum Catal. of R. C. S.
	B. Two Heads on One Body, Entire or Partial.	
139	2 Skulls united by their Vertices of a Double-Headed Male Child, Four Years Old	264
	C. Two Bodies having but One Head.	
140	One Head, 2 Necks and Bodies conjoined; the Hand is attached to the Arm at right angles ...	189
141	A-ke,[30] 1 Head, 2 Bodies, 4 Arms, 4 Legs (an Abortive Fœtus growing from Sternum of a Chinese Boy, Sixteen Years Old)	323
	D. Two Bodies and Two Heads Both Conjoined.	
142	Female Twin, Bodies and Heads United, the Heads Obliquely, only 1 Face	190
143	Female Twin, same as 190	191
144	Female Twin, Heads and Bodies United down to the Umbilicus; a Face on each Side; the Faces Lateral as regards the Bodies. From the Lumbar Vertebra everything is perfectly natural	192
145	Female Twin, like 192	193
146	Female Twin, Conjoined Bodies, and 2 Faces on One Side; only 2 Ears, 1 belonging to each Face	194
	E. Bodies Conjoined Transversely.	
147	Female Twin, Bodies United in a Transverse Direction; 1 of the Heads Imperfect	195
	F. Two Heads, One Body, Four Arms, and Three Legs.	
148	2 Heads, 2 Bodies United below Arms, 4 Arms, 1 Pelvis, 2 Perfectly-formed Legs, and an Additional Imperfect One growing from Sacrum	196

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[30] Dr. H. R. Davies, of Notting Hill, informs me, that "about 3 Years ago he saw a living Male Child, 2½ Years Old, with a Fœtus growing from the Abdomen. The Body of the Fœtus was perfect, and the Head retained in the Abdomen of the Child."

No.		No. in Museum Catal. of R. C. S.

G. Two Heads, Two Bodies, more or less Conjoined.

149	2 Heads, 2 Bodies United from Sternum to Umbilicus; Abdominal Walls Imperfect	182
150	Ditto.—See Note "Fusion of Muscles of Legs" ...	183
151	Ditto	184
152	Ditto	185
153	Ditto	186
154	Ditto	187
155	Ditto	188
156	Cast of the Siamese Twins	322

H. Additional Toes.

157	A Fœtus with 8 Toes on Right Foot, and 5 Toes on the Left; but the Great Toe projects like a Thumb; Left Foot Clubbed	8
158	A Portion of a Human Foot with Eight Toes ...	37

I. Bifid Rib.

159	A Human 4th Rib Bifid for 2½ Inches	376

2. *Monstrosity or Deformity in the* HUMAN BEING *arising from Deficiency of Parts.*

A. Deficiency of Head, Entire or Partial.[31]

160	A Male Fœtus found in the Body of John Hare—No Head	8
161	Human Fœtus, Calvarium Wanting...	93
162	Acephalous Human Fœtus	147
163	Ditto ditto	148
164	Ditto ditto	149
165	Ditto ditto	150
166	Ditto ditto	151
167	Ditto ditto	152

[31] Some years back I presented to the Museum of King's College, London, a Human Fœtus that was destitute of all the Upper Part of the Body. The wood-cut, No. 5, represents it.

No.		No. in Museum Catal. of R. C. S.
168	Part of the Head of a Human Fœtus with Deficiency of the Upper Lip, and having a Doubly-fissured Palate; Eyelids Imperfect	64
169	Ditto ditto	65
170	Ditto ditto	66

B. Deficiency of Trunk and Extremities or Parts.

171	Human Monstrous Fœtus; Absence of Abdominal Parietes; Abdominal Viscera Protruding	92
172	Ditto ditto ditto	93
173	Ditto ditto ditto	94

C. Deficiency of Arms, or Part of.

174	Human Monstrous Fœtus; Deficient Fore Arms; No Thumbs	92
175	Ditto. A Fleshy Projection ¾ of an Inch Long in Place of Left Arm. No Fingers	104
176	Ditto. Total Deficiency of Right Arm; the Left Rudimental and only 3 Inches Long	306
177	Ditto. No Fore Arms; Hands at Elbows	183
178	Ditto. Rudimentary Thumb	159

D. Deficiency of Legs, or Part of.

179	Human Fœtus; Deficiency of Both Legs. The Trunk Terminates in an Obtuse Rounded Stump	105
180	Ditto. Ditto. A Slight Rudimentary Projection from Sacrum	106

E. Deformity of Arms and Legs, or Part of.

181	A Female Human Fœtus; Arms and Legs Preternaturally short	108

F. Deficiency of one Eye (Cyclops).

182 A Male Human Fœtus, only 1 Eye. The Eyes are Conjoined and contained in 1 Orbital Cavity in the Centre of the Face, and a Proboscis in place of a true Nose.

It is almost impossible for any one to read over the foregoing List of Monstrosities and Deformities without being struck by the Uniformity with which *each* form, or type, of Monstrosity or Deformity recurs in the different classes of Animals, from the Worm (No. 61) up to Man;—for example, 1stly,[32] a Snake, a Dog-Fish, a Calf, a Lamb, a Pig, a Cat, and a Human Being with *Two* Heads on *One* Body;—2ndly,[33] a Pig, a Dog, a Cat, a Mole, an Earth-worm, and a Human Being with each *One* Head and *Two* Bodies;—again, 3rdly,[34] a Pig, a Dog, a Cat, a Carp, a Lamb, and a Human Being with a Part of the Head *deficient;*—or, 4thly,[35] a Pig, a Cat, a Dog, and a Human Being with only *One Eye* in the Centre of the Forehead and a Proboscis. Indeed we may carry this examination to every part of the Body, and we shall find that the *very same* forms of Monstrosity and of Deformity which occur in the Lower Animals, occur also in the Human Being, and are attributable to the *identical Causes* that gave rise to them among Animals.

The extraordinary position in which the Fœtus was found in each of the cases, Nos. 137 and 138, *viz.*, in the Body of a Male, may, probably, be referred to the arrival within the Uterus at the same time, of two impregnated Ova from the *same Ovary*,[36] which ova in their passage through the fallopian tube had become in some way entangled or united together; or it may be, simply placed in juxtaposition, and, as development proceeded, the Ovum in which development was the least advanced became at first merely adherent *to*, but afterwards it was received *into*, the other, and its development retarded, &c;—or, perhaps, to the existence of the same kind of Abnormity in the *Human Ovum*, which is demonstrated in the preparations of the College already cited, Nos. 1—7 inclusive, all of which preparations consist of *Eggs of the common Fowl, in two of which there are Two* [37] *Yolks in each Egg*—(see Diagrams 44 and 45)—in three of which, the Yolks are joined by a Pedicle—(see Diagrams 49 and 50)—and in one, an Egg covered by its proper Shell is contained within another

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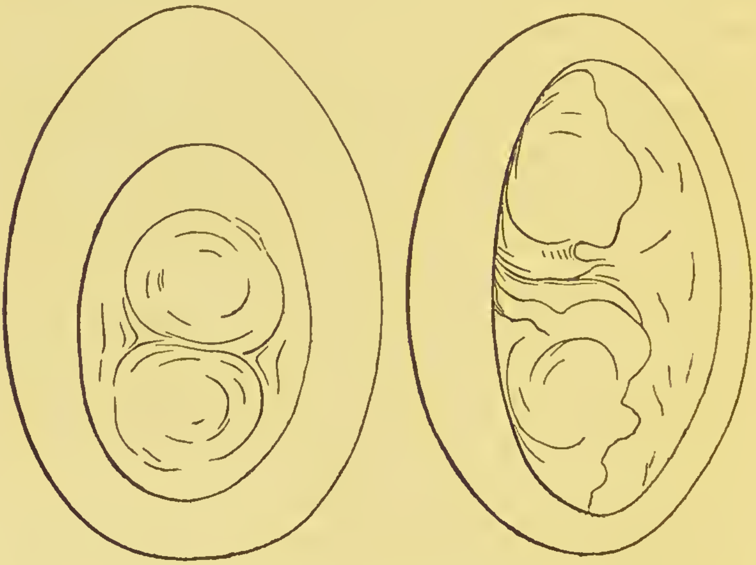
[32] See Nos. 31, 34, 35, 36, 37, 40, 139.

[33] See Nos. 41, 47, 48, 60, 61, 140, 141.

[34] See Nos. 82, 85, 86, 88, 89, 161—168.

[35] See Nos. 102, 104, 118, 182.

[36] "It is certain that Two Ova may be formed in One Graafian Vesicle."—*W. Vrolik, Cyclo. Anat. and Phys.*, p. 673. Also, "It may be mentioned that more than one Ovum have sometimes been found in the same Graafian vesicle, in which case it will readily be understood there might be only one Corpus Luteum in the Ovary, and two Ova in the Uterus, but this is rare."—*Art. Gener. Cycl. Anat. and Phys.* p. 450.


No. 44.

No. 45.

E. J. C.

44 and 45. Eggs of the Domestic Fowl with Two Yolks in each. (These Diagrams are drawn by myself from the Eggs in the Museum of the Royal College of Surgeons, No. 1 and 2, in p. 54.)

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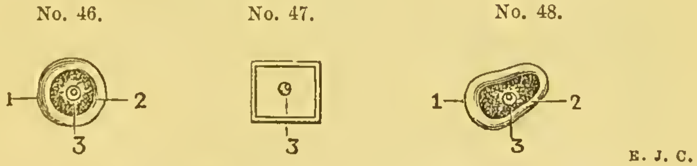
[37] See Note, p. 54.

perfect Egg (see Diagram 51); and I may here remark that, notwithstanding the extreme difficulty that besets the examination of this subject in the Human Being, from the rarity of opportunities of observation, as well as from the extreme minuteness of the Ova; nevertheless, there is some reason to believe that the same kind of Abnormity does exist; and moreover, it has been demonstrated by T. Wharton Jones, in his paper "On the Ova of Man and Mammiferous Animals, as they exist in the Ovaries before Impregnation, and on the discovery in them of a Vesicle analagous to that described by Prof. Purkinje in the immature Egg of the Bird," (read at the Royal Society, 1835), to which paper he has appended several Diagrams of Human Ova, and amongst these one that he describes as being "somewhat like two joined together." I have copied this Diagram, as it so distinctly bears upon our present enquiry (see Diagram 48).

It is remarkable that in each of the Cases to which I have just alluded (Nos. 137 and 138), the Fœtus was


No. 46. No. 47. No. 48.

(Copied from Wharton Jones.)

46. "A Human Ovum Magnified forty-five diameters. ...... The whole Germinal Vesicle (with its spot) is seen shining through the outer envelope."

47. This Diagram "represents within a square area, the Human Germinal Vesicle Magnified 45 diameters. On one side of it is seen the small elevation (the Germinal Spot)."

48. Deformed Human Ovum. Mr. T. Wharton Jones. "Philosophical Transactions," 1835, page 144. This Diagram "represents a Human Ovum which I found in the Ovary of a married Woman of about 30. It is somewhat like two joined together, but there is only one Germinal Vesicle."

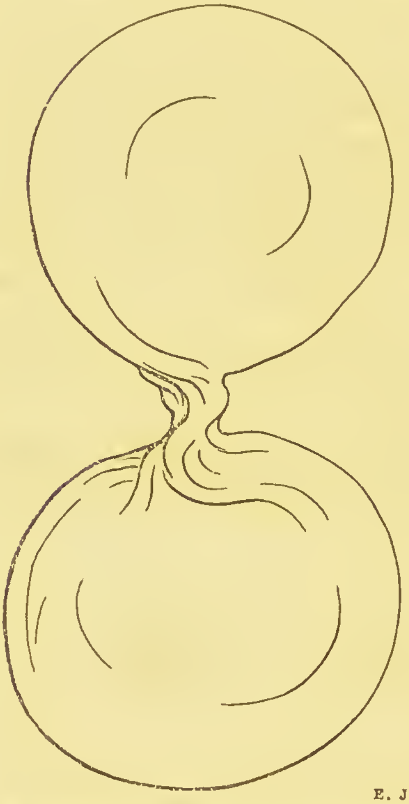
On this subject, see *Sycl. of Anat. and Phys.* vol. ii. p. 450, two Ova in Graaf. Ves.

The figures refer to all three :—

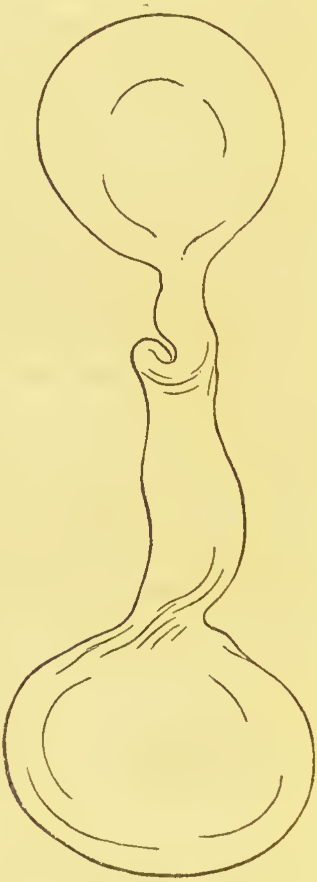
1, The Chorion, or outer coat.
2, The Vitellary Membrane and Vitellus.
3, The Germinal Spot.

deformed in a manner that could only have originated from Abnormity *in the Ovum*, or in the *Impulse of Development*;—*viz.*, in the Case of the Fœtus found in the Abdomen of Thomas Lane, one Hand had but *Three* Fingers, and one Foot had *Six* Toes;—and in the Fœtus found in the Abdomen of John Hare, one of the Feet had *Six* Toes, and the Great Toe is Split into Two smaller well-shapen Toes with Nails, like the Thumbs in Diagram 3, —and the Foot on the left Leg "is Mis-shapen in the

No. 49.



No. 50.



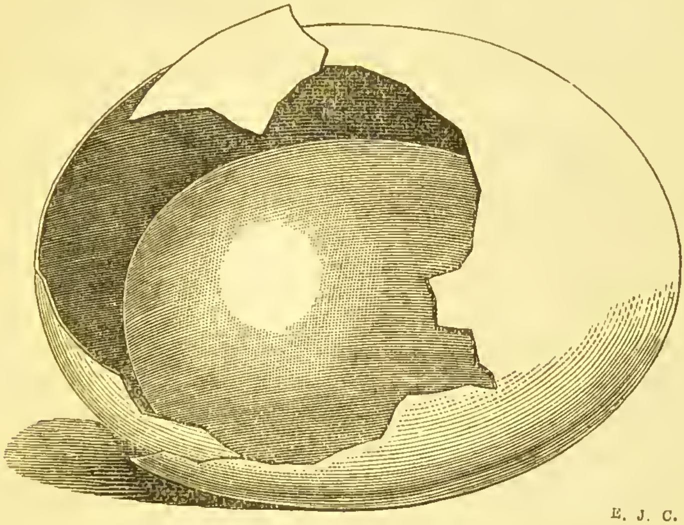
E. J. C.

49. Two Yolks joined by a long Pedicle, taken out of the Egg of a Domestic Fowl.
50. Two Yolks joined by a short Pedicle, taken also from an Egg of the Domestic Fowl. (These Two Diagrams are drawn by myself from the preparation in the Museum of the Royal College of Surgeons, Nos. 3 and 4, in p. 54.)

Manner of a Club-foot," and the Great Toe projects considerably outwards, like a Thumb separated from the Fingers like Diagram No. 1.

As the foregoing Cases *admit of no dispute*, they constitute the *presumptive* proof, that in the Human Being, as well as in Animals and Vegetables, error does occasionally exist in *the Impulse of Development originally imparted to the Ovum by Impregnation*, or that it *exists in the Ovum itself*;—and, therefore, such proof, added to those already adduced from the Lower Animals (*especially Birds*) and from the Vegetable Kingdom, establishes the correctness of the First of the Causes I have specified upon my table. (Page 44.)

No. 51.



51. A Swan's Egg, containing a Second Perfect Egg within it. Drawn from a Specimen in a Case in the Gallery of the Museum of the Royal College of Surgeons, presented by Sadlow Roots, Esq., of Kingston-on-Thames. This preparation is not yet numbered.

Although the evidence hitherto examined satisfactorily proves the existence of error in the Primary Impulse, or in the Ovum, there is yet *in Man* a *second* and still *more conclusive proof* remaining than anything I have as yet adduced, which proof will become manifest as we proceed in the consideration of the 2nd Cause, *viz.*, "Hereditary Influence."

It has occasionally attracted the observation of Mankind, that the Members of certain Families have been characterised by some Peculiarity of Body,[38]—or of Mind,[39]—or even of disease,[40] for successive generations.

In some instances the Peculiarity observed has consisted in Regularity and Beauty of the Features;—or in Height of Stature:—or in the Proportionate Length and Shape of the Limbs and Symmetry of the Body generally;—in other instances the Peculiarity has been a Blemish[41], perhaps a mere Mark upon the Skin—or a positive Deformity, such as the possession of Supernumerary Fingers or Toes, or of a Deficiency of such parts;—or even of a Monstrosity, as the possession of but One Eye, &c., as found to exist in some of the Cases I have already brought forward.

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[38] Dr. Allen Thompson, in the *Ency. of Anat. and Phys.*, remarks:—"We may also mention, in connection with this subject, the transmission to the Offspring of various Marks and Deformities in the Structure of the Parents or their Relations. In many instances, the Hereditary Cause of the Deformities has been distinctly traced to *one* or the *other* of the Parents. Nœvus, Moles, Growths of Hair in Unusual Places, Hare-lip, Deficient or Supernumerary Toes or Fingers, have all been traced to HEREDITARY Influence, and probably as often to the one Parent or his Family as to the other."—*Art. Generation, p.* 471.

[39] Dr. George Coombe, in his Work on *The Constitution of Man*, remarks, that "Form, Size, and Quality of the Brain, like those of other parts of the Body, are Transmissible from Parents to Children; and hence Dispositions and Talents are Transmissable."—Page 42.

[40] Dr. Allen Thompson, in the Article Generation, p. 471, of the *Encycl. of Anat. and Phys.*, remarks: "Almost all the forms of Mental Derangement are more or less directly Hereditary, one of the Parents or some near Relation, being affected."—"Of Bodily Diseases, Pulmonary Complaints, Diseases of the Heart, Scrofula, Rickets, Worms, Gout, Rheumatism, Hæmorrhoids, Hypochondriasis, Scirrhus, Apoplexy, Cataract, Amaurosis, Hernia, Urinary Calculi, may be mentioned as examples of Diseases more or less directly Transmitted as Predispositions from Parents to Offspring. The Goitral and Cretinous Affections, combined with Deficient Intellect, are striking Examples of the Effect of Hereditary Influence, combined with that of the situations in which the Cretins live."

The occurrence of any Peculiarity of Form in a Child born of Parents not possessed of such characters themselves, must be regarded as an *accidental* Variation resulting from one or the other of the causes previously considered, or from some of those hereafter to be brought under your notice; but the *re*currence of the same peculiarity in the offspring, in the second or subsequent generations, is no longer regarded as proceeding from a similarly accidental Cause; but is looked upon, especially after the second generation, as an expected event, and is designated by the common consent of mankind as a Transmitted or Hereditary Peculiarity.

The occurrence of the first step in the process, *viz.*, the production of a Casual or Accidental Variation in Form in One Member of a Family may be frequently seen;[42] and it therefore merely requires me to direct

[41] Dr. H. Stavely King has recently afforded me the opportunity to examine the Eyes of a Young Woman in whom the Sclerotic Membrane is perfectly Blue; and she informs me, that both her Mother and her Grandfather, had the Eyes of the same dark blue colour.

[42] "Meckel saw, in one single instance, this Antithisis extend itself over different Children of one and the same Mother. A Girl had on each extremity a Superfluous Digit, and One Hand of Her Sister wanted Four Fingers, being the Number of Digits which her Sister had in Excess, reckoning the Four Extremities together."—*Cycl. Anat. and Phys.* vol. iv. p. 946.

your attention to the fact. I cannot, however, refrain from bringing under your notice an interesting Case of the kind that has fallen under my own observation, in which the *Two eldest* Children (both Male) of a Family of *Six*, whose Parents were *not* in any way deformed, were each born with a Bifid Thumb on *One* Hand. The Deformity was exactly like Diagram 3, and in the eldest Child it was situated on the Right Hand, and in the youngest on the Left. A period of Seven Years elapsed between the birth of the first and the second Child, while between the remaining four, who were *not* deformed, there was only about the average time (*viz.*, Twenty Months) between any two of them. Each of the Brothers has married and has Children, yet in neither of the Children is the Deformity perpetuated. The Cases, or, at all events, the *first* Case, *i.e.* the eldest, affords a fair example of the Casual or Accidental production of Deformity;—*but*, are we to consider the *re*currence of the *identical* Deformity in a second Child, born after a lapse of Seven Years without an intervening Pregnancy, in the same light?—or, is it to be attributed to the effect of some Definitely Acting Cause? I think it probable that it is due to some Definite Cause, and I will attempt an explanation after I have brought forward a most singular instance of Family Deformity, narrated by Mr. Tamplin,[43] in which instance several Children were each born similarly deformed in the Feet from Parents *not* so deformed themselves, at least Mr. T. does not say they were, and he would most assuredly have mentioned such a fact had it existed. The account runs thus, "I know of one instance where a Family of eight Children had a Double Varus, and the Parents refused to have anything done, for fear of destroying their uniformity."

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[43] Lectures on the "Nature and Treatment of Deformities," by R. W. Tamplin, page 17. 1846.

In the cases just cited from Mr. Tamplin, I consider the occurrence of the Deformity in the *eldest* child as a fair example of the assumed accidentally (?) produced Deformity; *but* is the *re*currence of the like Deformity in the feet, in the *seven following Children*, to be deemed Accidental?—or, is it not rather due to the action of some *Definite Persistent Cause?* When speaking of my own cases of the recurrence of a Bifid Thumb, I ventured to suggest that this recurrence of a particular Deformity was attributable to a Positive Cause; and I will now draw your attention to a fact well known to Physiologists, *viz.*, that the influence of a *first Impregnation* does *not pass off* entirely with the *first-produced offspring*, but, on the contrary, that it materially influences several of those which immediately succeed it, by *partially impregnating* the Ova then in existence in the Ovary of the Female.

Thus Mayo states, "Some remarkable instances, which have recently attracted notice, seem to show that in the higher animals the influence of the male is extended even beyond a single impregnation."[44] And he then proceeds to quote a Case from the Philosophical Transactions (1821, p. 21), in which "a seven-eighths Arabian Mare, belonging to the Earl of Morton, which had never been bred from before, had a mule by a quagga: subsequently she had three foals by a black Arabian Horse. The two first of these are thus described:—They have the character of the Arabian breed as decidedly as can be expected, where fifteen-sixteenths of the blood are Arabian; and they are fine specimens of that breed; but both in their colour, and in the hair of their manes, they have a striking resemblance to the Quagga. Their colour is bay, marked more or less like the Quagga in a darker tint. Both are distinguished by the dark line along the ridge of the back, the dark stripes across the fore hand, and the dark bars across the back part of the legs. Both their manes are black; that of the filly is short, stiff, and stands upright; that of the colt is long, but so stiff as to arch upwards, and to hang clear of the sides of the neck, in which circumstance it resembles that of the Hybrid. This is more remarkable, as the manes of the Arabian breed hang lank, and closer to the neck than those of most others.”

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[44] "Outlines of Human Physiology," by Herbert Mayo, F.R.S., page 489. 1829.

The foregoing, however, is not the only instance he cites, as he proceeds to remark:—“A similar occurrence to the preceding is mentioned by Mr. Giles respecting a litter of Pigs, which resembled in colour a former litter by a Wild Boar.” And he then makes this important remark:—“The best explanation of these phenomena is to suppose that connexion with the Male produces a physical impression, not merely upon the ova, which are ripe for Impregnation, but upon others, likewise, that are at the time immature. In Gallinaceous birds, in turkeys for instance, it is well known, that a single coïtus will actually impregnate all the ova that are laid during the breeding season. The explanation, which I have offered, seems to me far more reasonable than any supposed influence of the imagination, the effect of which on any occasion, even in Human Beings, appears more than doubtful."

That such an Influence is exerted upon the *second*, or even the *subsequently* born progeny, is also testified by Allen Thomson, who adduces many instances, and remarks:[45] "Instances of the same kind are mentioned by Burdach, as occurring in the sow and bitch; and it is affirmed that the human female also, when *twice married*, bears occasionally to the second husband children *resembling the first*, both in bodily structure and mental powers."

Since the publication of the foregoing well-known and accredited cases of this Partial Fecundation of a series of ova that are destined to remain an indefinite time in an immature condition in the Ovary of the Female, an explanation of the manner in which it (the partial impregnation) is effected has been afforded by direct experience, of which Dr. Carpenter says, "It appears from Mr. Newport's[46] ingenious experiments, that the contact of a Single Spermatozoon is not adequate to produce complete. Fecundation; but that the penetration of a certain number of Spermatozoa is requisite; and he has ascertained that Fecundation may be effected *partially* (so as to occasion *some*, though not all, of the Normal Changes in the Ovum) by a smaller amount."[47]

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[45] *Art. Gener.*, *Cycl. Anat. and Phys.*, vol. ii. p. 468.

[46] In a postscript to the work referred to, page 536, written almost contemporaneously with Mr. Newport's decease, Professor Bischoff states, that he has himself confirmed Mr. Newport's observation of the penetration of the Spermatozoon into the Ovum of the Frog, and gives him full credit for the determination of this important fact."—*Dr. Carpenter*, Note to Preface, p. x.

As it is, therefore, an ascertained fact, that it requires a certain number of Spermatozoa to effectually fecundate an Ovum, and that the contact or union of a less number with the Ovum only partially fecundates it, *i. e.*, partially endows it with the Hereditary Mental and Bodily peculiarities of the Male; or, as Mr. Newport expresses it, "so as to occasion *some*, though not all, of the Normal changes," this perfectly explains the *re*currence of the Bifid Thumb and of the Club Feet in the cases that I brought forward from my own practice, and from Mr. Tamplin's Lectures, *viz.*: that at the first Impregnation of the Female, who gave birth to the children with the Bifid Thumbs, *two* Ova were fecundated. *One entirely*, so that it became fully developed, and gave origin to the first born with the Bifid Thumb on the right hand; and a *second*, which was *only partially* fecundated, *i. e.*, sufficiently fecundated to give rise to the commencement of the specific changes that would ultimately lead to the production of the like Deformity, but not sufficiently so as to cause the immediate development of the Ovum into an Embryo;—so, likewise, with Mr. Tamplin's Cases, the first Impregnation, not only fecundated and imbued the first Ovum with an Impulse that gave rise to Club Feet in the first born; but, *also partially fecundated seven other* Ova, all of which in due time, on Fecundation being subsequently completed, gave rise to Children with Club Feet like the eldest. In both these instances, therefore, the Abnormal Impulse proceeded from the Father's side.

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[47] Principles of Comp. Phys., by W. B. Carpenter, M.D., F.R.S., p. 536.

Whenever a person who is thus casually, or accidentally deformed, has children who are deformed in the same manner, such cases constitute examples of Hereditary, or Transmitted Deformity, as in the following well-marked case, which occurred in my own practice a few years back, the particulars of which are as follows:—A Gentleman brought his Child to me to be treated for Club Foot. The Father was himself the subject of Club Foot, and he informed me that he had been twice married—that by his first Wife he had had three Children, *all of whom were Normally formed*—and that, by his second Wife, he had had ten Children, *all* of whom, except the youngest, were born with Club Foot.

A second and even still more remarkable Case has recently come under my notice, in which the Deformity has passed through at least three generations. The particulars are as follows:—There were two Brothers, George and Edmund ———, of ———, and of whom the Elder (George) had Two *perfect Thumbs* on *each* Hand; and the Younger (Edmund) had the Hands perfectly Normal. It is not quite certain, but there is a surmise in my informant's mind, that some parts of the Father's Family were also deformed in the Hands. Of the above Brothers, George and Edmund, the Younger one, who was not himself deformed (Edmund) married twice, and by each Wife he had Children that were deformed in the Hands. By his first Wife he had two Children; the Elder (Mary) whose hands *were perfectly Normal;* and the Younger (Charlotte), who had on each Hand 5 perfect *Fingers*[48] and *no* Thumbs. The Elder Daughter of this first marriage, whose Hands (be it remarked) were perfectly Normal, married, and gave birth to three Children, of whom the first (a Son) had 2 Thumbs in each Hand, like the Grandfather's Brother (George). The other 2 Children were perfect. The Younger Daughter of the first marriage (Charlotte) also married and gave birth to 2 Children. The first (a Son), whose Hands were perfect; and the second (a Daughter), who had on each Hand 5 Fingers and *no Thumbs*, like the Mother. By his (Edmund's) second Wife he had nine Children, of whom the third (George) has 2 Thumbs on one Hand. The fourth (William) has all Fingers on both Hands and *no* Thumbs; and the seventh has 2 Thumbs on one Hand. The remaining six were Normal. Of these nine Children all but one had married and become Parents; but only one, *viz.*, the seventh Daughter (Louisa) had a deformed Child. In this case she gave birth to a Daughter with *all Fingers* and *no* Thumbs. My informant had married the Eldest Daughter (Anne), and he states that he has had *fourteen* Children, all of whom had perfectly Normal Hands; but he gives a most graphic description of his Wife's *alarm and mental anguish*, for a *long time* previously to the birth of her first Child, lest her Children should be born with deformed Hands like those of so many of the Family. This latter part, *viz.*, the mental anguish during so long a period of her pregnancy, and the subsequent birth of a perfectly Normal Child, is one of considerable interest in connexion with the next supposed Cause of Deformity, and I shall revert to it again in the next Lecture.

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[48] See Diagram 52, in which there are 5 Fingers but webbed together.

A third and equally remarkable example of unquestionable Hereditary Influence has recently been brought under my notice by my friend Doctor T. Pollock, of Hatton Garden, who kindly afforded me the opportunity of examining the Hands of the Children of one of his patients.

The Deformity consisted of an absence of a moveable Articulation between the second and extreme Phalanges of the Fore *or Index* Finger, whereby the Finger possessed but *two* instead of *three* joints. In other respects the Finger is quite Normal in appearance. There are eight Children, and out of these *five* are thus deformed, *viz.*: two in *both* hands, and three others on *one* hand only. The maternal Aunt of these Children informs me, that to her *own* knowledge, the Deformity has been peculiar to *her* family for *four* generations, and that she could trace it up through both *Male* and *Female* branches to the Great-grandmother of the Children I had examined. She had *heard* that it existed in the previous generation.

The foregoing cases are most interesting in several points of view, as regards Hereditary Influence on the Offspring, and the elucidation of the Causes of Deformity; inasmuch as we have in them the proof that the exciting Cause of the Deformity had proceeded in several instances both from the *Male* and *Female* branches of the family; and, therefore, according as it was from one or the other, it affords direct and absolute proof that the abnormal influence, when on the *Mother's* side, existed originally in the *Ovum*, or, when on the

Father's, was directly imparted to the Ovum *by Impregnation* ; thus adding a most conclusive argument in support of the first-named Cause of Deformity, *viz.* : Error in the Primary Impulse of Development, or, in the Ovum previously to Impregnation.

That Hereditary peculiarities passing from Parent to Offspring from *generation* to *generation*, and thus giving rise to a *variety*, occasionally exist in both the lower Animals and Man, I will now cite three of the most remarkable, and, at the same time, best authenticated instances.

The first Case I shall adduce is an excellent example in the Sheep,[49] noticed by Dr. Carpenter in his "Physiology." It is as follows:—"Advantage has been sometimes taken by Man of spontaneous variations of this kind for some purpose useful to him, and he has exerted his skill to perpetuate them. The following example is of comparatively recent occurrence. In the year 1791, one of the ewes on the farm of Seth Wright, in the state of Massachusets, produced a male lamb, which, from the singular length of its body, and the shortness of its legs, received the name of the *otter* breed. This physical conformation, incapacitating the animal from leaping fences, appeared to the farmers around so desirable that they wished it continued. Wright determined on breeding from this ram, and the first year obtained only two with the same peculiarities; in the following years he obtained greater numbers; and when the offspring became capable of breeding one with another, a *new and strongly-*

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[49] Philosophical Transactions, 1813.

marked Variety, before unknown to the World, was established."[50]

The foregoing Case, related by Dr. Carpenter, is especially deserving of notice, because it is distinctly pointed out in it that Lambs of the peculiar Shape were obtained *two or three years following* from the SAME RAM, out of Ewes of a *different* form. In all these cases, therefore, they were distinctly *hereditary on the side of the Male*, *i.e.*, the pure result of the peculiar influence communicated to the Ovum at Impregnation; but afterwards, "when the Offspring, both *Male* and *Female*, became capable of Breeding," &c., *i.e.*, when the *Ewes of this Peculiarly Formed Breed* were old enough to be used for breeding with *Rams* possessed of the same Hereditary Peculiarity, so that its influence on both sides could be brought to bear on the progeny: then a *variety* was produced, in which *all* the *Offspring* were similarly formed.

The next two Cases are as positive Examples of Hereditary Peculiarity in the Human Being, and they are brought forward by Dr. Prichard in the first volume of his "Researches into the Physical History of Mankind," p. 347, from which the following is merely an extract:—

"I shall conclude the section with a very remarkable variety which has appeared in the human species.

"The first account of this phenomenon is to be found in the 'Philosophical Transactions' for the year 1731. A Boy, aged 14 years, was brought by Mr. Machin, one of the Secretaries from the neighbourhood of Euston-hall, in Suffolk, his native place, and exhibited to the Royal Society. His Body was covered by a remarkable kind of Integument which is thus described by Machin.

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[50] Principles of Comparative Physiology, by W. B. Carpenter, M.D., F.R.S., page 638.

"His Skin, if it might be so called, seemed rather like a dusky-coloured thick case exactly fitting every part of his body, made of a rugged bark, or of a hide, with bristles in some places; which case covering the whole, excepting the face, the palms of the hands, and the soles of the feet, caused an appearance as if those alone were naked and the rest clothed. It did not bleed when cut or scarified, being callous and insensible. It was said he sheds it once every year, about Autumn, at which time it usually grows to the thickness of three quarters of an inch, and then is thrust off by a new skin which is coming up underneath."

Dr. Prichard then proceeds to enumerate the opinions respecting the nature of the Covering, stating that some "compared it to the Bark of a Tree," others to "Seal-Skin," to "Elephant Skin," or "Skin about the Legs of a Rhinoceros," "and some took it to be like a Great Wart, or number of Warts, uniting and overspreading the whole body." The bristly parts, which were chiefly about the belly and flanks, looked and rustled like the bristles or quills of a Hedgehog shorn off within an inch of the skin."

The second account of this Person was communicated to the Royal Society by H. Baker. He was at that time 40 years of age, and had been shown in London by the name of the Porcupine Man. He is described as a good-looking well-shaped Man, and his skin is all over covered in the same manner as in the year 1731, which I shall trouble you with no other description of than what you find in Mr. Machin's account abovementioned.

"When I saw this Man in September last, they were shedding off in several places, and young ones of a paler brown observed succeeding in their room, which he told me happens annually in some of the autumn or winter months, and then he is commonly let blood, to prevent some little sickness, which he else is subject to, whilst they are falling off. At other times he is incommoded by them no otherwise than by the fretting out of his linen, which he says they do very quickly; and when they come to their full growth, being then in many places near an inch in height, the pressure of the clothes is troublesome.

"He has had the Smallpox, and has been twice salivated, in the hopes of getting rid of this disagreeable covering; during which disorders the warting came off, and his skin appeared white and smooth like that of other people; but, on his recovery, soon became as it was before. His health at other times has been very good during his whole life.

"But the most extraordinary circumstance of this man's story, and indeed the only reason for my giving you this trouble is, *that he has had six children, all with the same rugged covering as himself;* the first appearance whereof in them, as well as in him, came on about nine weeks after their birth. Only one of them is living, a very pretty boy, eight years of age, whom I saw and examined with his father, and who is exactly in the same condition.

"It appears, therefore, past all doubt," says Mr. Baker, "that a race of people may be propagated by this Man having such rugged coats or coverings as himself; and if this should ever happen, and the accidental original be forgotten, it is not improbable they might be deemed a different species of mankind."

Dr. Prichard then proceeds :—"It seems that a *third* generation of this singular Family is in existence. A description of two individuals, who must be of the third degree from the original patriarch of the stock, has been published by Dr. W. G. Tilesius, and by Blumenbach. Mr. Lawrence has given an abstract of these accounts :—'Two brothers,' says Mr. Lawrence, 'John Lambert, aged 22, and Richard, aged 14, who must have been grandsons of the original porcupine man, Edward Lambert, were shown in Germany, and had the cutaneous incrustation already described. Tilesius mentions that the Wife of the elder, at the time when he saw him, was in England, pregnant.' I have seen," says Prichard, "an individual, whose skin was covered with warty excrescences, and who gave himself out to be a descendant of the Lambert family."

In the foregoing Case, therefore, we have a peculiarity originating in a single individual, propagated through three generations, or strictly inherited from Father to Son.

In another part of the same work (p. 368), Dr. Prichard introduces a second instance of Hereditary Transmission of an Accidental Peculiarity, which I shall also avail myself of, as it is well authenticated, and, likewise, from the "Philosophical Transactions." (55th Vol.)

In relating the following case, Dr. Prichard remarks:—"As the facts of this Case are very remarkable and well authenticated, I shall copy the account which was communicated to the writer (Dr. Parsons) by a respectable lady, who had resided in Virginia:"—

"'About nineteen years ago, in a small plantation near to that of this family, which belonged to a widow, two of her slaves, being *black*, were married, and the woman brought forth a *white* girl, which this lady saw very often, and, as the circumstances of the case were very particular, I shall make mention of them here:—When the poor woman was told the child was like the children of white people, she was in great dread of her husband, declaring at the same time that she never had anything to do with a white man in her life, and therefore begged that they would keep the place dark that he might not see it. When he came to ask her how she did, he wanted to see the child, and wondered why the room was shut up, as it was not usual. The woman's fears increased when he had it brought into the light; but while he looked at it he seemed highly pleased, returned the child, and behaved with extraordinary tenderness. She imagined that he dissembled his resentment till she should be able to go about, and that then he would leave her; but in a few days he said to her, "You are afraid of me, and therefore keep the room dark, because my child is white, but I love it the better for that; for my own father was a white man, though my grandfather and grandmother were both as black as you and myself; and although we came from a place where no white people were ever seen, yet there was always a white Child in every family that was related to us." The Woman did well, and the Child was shown about as a curiosity, and was, at about the age of 15, sold to Admiral Ward, and brought to London in order to be shown to the Royal Society.'"

As the Cases just cited, especially that of the Porcupine Man, are so well authenticated, it is needless to add to their number. I ought, however, before passing from this subject, to mention, that among the peculiarities known to be Hereditary,[51] there are many which fall under our especial notice, as they consist of absolute Deformities in a *surgical* sense.

Among the latter class of Cases will be found instances of supernumerary Fingers or Toes; or, on the other hand, of Deficiency of the like parts; or, the Fingers or Toes may be more or less webbed together, as in Diagram 52, p. 87; or, of Club-Foot; or, of Contracted Hand; or other parts, all of which are acknowledged by medical and surgical writers to be *occasionally* Hereditary.

As I have thus advanced proof of the efficiency of the Second Cause, *viz.:* "Hereditary Influence," to produce Deformity, we have *in it* the *additional and conclusive proof derived from the Human Being*, to which I referred a short time back, of the correctness of the

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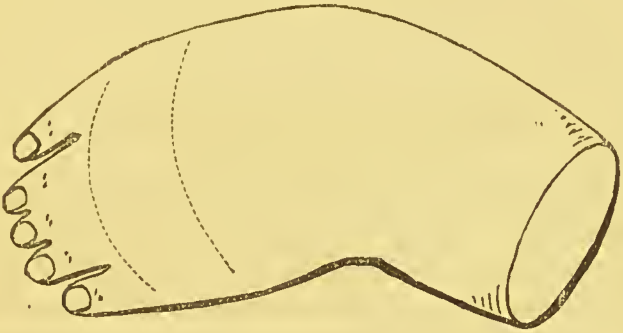
[51] "All Varieties of Structure, which are congenital, or a part of the original constitution impressed upon an individual from its birth, or arising from the development of a natural tendency, are hereditary, or liable, with a greater or less degree of certainty to be transmitted to offspring. In general, the peculiarities of the individual are transmitted to his immediate descendants: in other instances they have been observed to reappear in a subsequent generation, after having failed, through the operation of some circumstance quite inexplicable, to show themselves in the immediate progeny."—*Researches into the Physical History of Mankind, by J. C. Pritchard, M.D.*, vol. i. p. 366.

First Cause on my table, *viz.:* that the *Primary Impulse of Development is occasionally Abnormal*, or, that the *Ovum itself, previous to Impregnation, was imperfectly*

No. 52.



52. The right hand of an infant ten weeks old, *actual size.* The fingers, of which there are five and no thumb, are all webbed together. The dotted lines represent the situations of the joints (knuckles), none of which however presented any external appearance by which they could be recognised by the eye. The finger in the situation of the thumb is as long as the others, has three joints, thereby clearly distinguishing it as a finger from a thumb, which has only two.

formed;—for it is self-evident that in the instance of the transmission from generation to generation of a Peculiarity of Form *appertaining to the Father*, for example, Six Fingers or Toes, the vivifying Impulse which gave rise to such a Peculiarity *must have been transmitted to the Ovum at the moment of Impregnation;* while, on the other hand, assuming the aforesaid Deformity to have *been peculiar to the mother's family*, it is equally clear that the *abnormal tendency must have existed in the Ovum itself previously to its Impregnation and liberation from the Ovary;* therefore, such Cases afford the direct proof that the Spermatozoa of the Male performs no more important part towards the future Animal than does the Ovum that is impregnated by them.

SYNOPSIS OF LECTURE III.

Continuation of the Causes inducing Congenital Deformities—Consideration of the Causes assigned as capable of exerting a baneful Influence on the Embryo;—1stly, Mental Emotion,—as Fright, Longing, &c.—Opinion of medical men in support of the current belief in the efficacy of such a Cause—Reported Cases in which Deformity is stated to be so induced—Arguments on which is founded an opinion in opposition to such a belief.—Consideration of the Second assigned Cause, *viz.*, Arrest of Development—Many Deformities only the Persistence of some of the perfectly Normal Conditions of the Embryo—Consideration of the Causes which are capable of exerting an Influence on the Embryo or Fœtus from without, *i.e.*, Mechanically—1stly, Ligature of the Funis; examples—2ndly, Thread-like Bands, examples—3rdly, Adhesion to the Membranes, or of the Placenta, to the Embryo or Fœtus—4thly, Constriction from "Position in Utero."

LECTURE III.

CAUSES OF DEFORMITY ACTING ON THE EMBRYO.

In my last Lecture I proved beyond the possibility of a doubt, the existence of the First and Second of the Causes of Deformities placed upon the table (page 44), *viz.*: 1stly, Error in the Primary Impulse of Development, or, originally existing in the Ovum; and, 2ndly, of Hereditary Influence. I have now to proceed to the Examination of the Third, *viz.*: Mental Emotion of the Mother.

The two preceding Causes, into the nature of which we have already examined, appertain entirely to the *Ovum;* but you will observe the present Cause is *reputed* to exert its Influence, not only upon the Ovum, but also upon the *Embryo* and *Fœtus.*

From olden time to the present moment, the opinion that *Mental Emotion* during Pregnancy, occasioned by Fright on beholding some hideous or disagreeable Object;—or *longing* for particular articles of food,[52] dress, &c., was productive of Blemishes, or of Deformities resembling the *Object* which gave rise to the Fright, or to the *Article* longed for, has been more or less popularly believed, in which belief not a few of the Medical Profession have coincided, and do so even to the present day.

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[52] For example, a particular Strawberry, which some person takes up and eats, thus causing disappointment, from which circumstance, according to the general belief, if the Lady happens to touch her own Nose or Chin, or any other part of her Body, the Strawberry immediately becomes developed on the same part of her forthcoming Child.

In order that I may not incorrectly advance a statement respecting the opinions of the Medical Profession, I shall avail myself of two or three Cases that were published in the "Lancet," in October and November, 1850.

The First Case is from a Tutor in Midwifery, and is headed "Lamentable Effects of the Mental Emotion of the Mother on the Fœtus in Utero." It is as follows:—"The question whether the Mental Emotions of the Mother can influence the Child in Utero has been debated from time immemorial, some arguing for, and others against it. That such was the popular opinion in very ancient times, we learn from the xxx chapter of Genesis; in which we are informed that Jacob, in order to render the cattle striped, speckled, and spotted, placed peeled rods before the eys of the Females in the act of Copulation; and in modern days the opinion has been supported by Meckel, Soemmering, Breschet, Serres, and Geoffrey St. Hilaire; while, on the contrary, it has been disputed by many Tutors on Midwifery, and amongst the latter by myself, who drew my conclusions in consequence of being cognizant of many cases of women having been exposed to mental disturbance and unpleasant sights without any effect on their offspring; but I am now converted to the opposite opinion, from numerous incontrovertible facts which have come lately within the range of my own observation. The *modus operandi* I do not pretend to explain; but Geoffrey St. Hilaire, who has written largely on the subject, attributes Monstrosities and Deformities to long continued pressures on the abdomen of the mother, or to the fact of her having been exposed to long continued mental Emotions. Now in the case which I am about to relate, a passing thought arising from the sight of a deformed child, and which thought was forgotten for months, was sufficient in a woman in the Sixth Week of pregnancy, to lop off two arms from the child she was then bearing, exactly corresponding with the deformity which existed in the child she saw. The following are the particulars of the case:——Mrs T———, of Little Moorfields, of average stature, sound health, and between Twenty-five and Thirty Years of age, was confined with her second Child on the 10th of June, 1850. Her first labour was tedious and severe, in consequence of which the Infant was still-born, but without Deformity. In this instance the labour was both easy and natural, and the Child, which was a fine healthy Boy, was found to be well developed in every respect, except that he was deficient of both Arms. On the left side, the glenoid cavity and acromion process of the scapula may be plainly felt; but there is not the most rudimentary trace of a humerus. The right side is similar to the left, with this exception, that there is a fleshy protuberance attached to it of about two inches in extent, which protuberance is surmounted by a well-formed finger.[53] On being shown her infant, and the deformity pointed out, she made the following statement:—'That she was one day walking down the Minories, where she met a child without arms, and similar in every way to her own—that she was horrified at the sight, but that she had entirely forgotten the occurrence; and that this happened about the sixth week of pregnancy, when she was in doubt whether she was in the family way or not.'

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[53] Diagram 14 is an example of the same kind of Deformity.

"A non-professional gentleman, to whom I mentioned the circumstance, informs me that the Child is to be seen any day in the Minories, showing its deformity to the passers by, and which he describes to be similar to a woman's breast surmounted by a nipple.

"I would here beg to observe that it is both cruel and disgraceful to allow this child to run at large without its being properly clothed, so as to hide its deformity; because inasmuch as it has been sufficient to affect one pregnant woman, there is no reason why it should not similarly affect hundreds of other women, out of the thousands and tens of thousands which pass along that great thoroughfare, and it must be confessed that the loss of both arms to those who have to obtain their living by their own handwork is a most serious and lamentable affliction. The Infant is living and doing well.

"I am, sir, yours truly,

"R. Davis, M.R.C.S."

"*Brunswick Place, City Road.*"

In the Case I have just read, you will observe,—

1stly. That the cases mentioned in Holy Writ were stated in a popular manner to be caused by placing the rods "before the flocks in the gutters in the watering troughs when the flocks came to drink; that they should conceive when they came to drink," verse 38, chap. xxx., which Mr. Davis himself renders, "*before the eyes of the Females in the act of Copulation*;" and, therefore, that it in no way applies to, or supports the opinion afterwards advanced by Mr. Davis. Moreover that another, and most persons will think, a much more certain Cause than the peeled rods is mentioned afterwards in Genesis xxxi. 11, 12, *viz.* :—

"And the angel of God spake unto me in a dream, saying, Jacob. And I said, Here am I.

"And he said, Lift up now thine eyes and see, all the Rams which leap upon the cattle are ring-streaked, speckled, and gristled: for I have seen all that Laban doeth unto thee."

2ndly. That, although Mr. Davis formerly disbelieved in such a Cause of Deformity, he is *now converted* to the opposite opinion, from numerous *incontrovertible facts*; but he does not inform us what those facts are.

3rdly. That the Deformity in the Case narrated was produced by "*a passing thought*," which "was forgotten for months."

4thly. That the Deformity produced was *identical with* the preparations[54] in the Museum of the Royal College of Surgeons, to which I directed your attention in my last Lecture.

And lastly. That if the Child in the Minories has caused the hundreds of Cases of Deformity imagined by Mr. Davis, I fear that the good effected by this Hospital and the Royal Orthopædic Hospital is more than counterbalanced by the thousands of Cases of Deformity which, if Mr. Davis is correct in his opinion, must have resulted from the collection of so many Deformities together, and their consequent exposure to the sight of the numerous Child-bearing Women who attend with them on every admission day, who cannot fail to have their attention especially directed to the more severe Cases around them. But on *this* point I must beg of you to suspend your judgment until the end of the Lecture, by which time I hope to be able to relieve your minds from any such disagreeable impression. I may, however, here remark, as a matter of fact, that I have now been attached to this and the Royal Orthopædic Hospital together Seventeen Years, and yet during all that time I never heard of a single case that was *even reported* to arise from anything occurring, or, that had been seen at either Hospital.

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[54] See Nos. 174, 175, 176, 177, p. 64, and Diagram 14.

The Second Case runs thus:—It is from a Gentleman who signs himself J. S., and it is written *in support* of the opinion advanced by Mr. Davis:—

"My experience, though not very extensive, will supply a Case, which to me (and perhaps some other of your readers will agree with me) proves the reverse of the position assumed by your correspondent Dr. Richards" (Dr. Richards had written *in opposition* to the opinion advanced by Mr. Davis) "in the 'Lancet' of last week. Some eight or nine years since, I attended a lady in her first confinement. Immediately on the birth of the child she asked to see it. After some hesitation on the part of the attendants it was shown to her, when she burst into tears, exclaiming, 'It is as I expected.' The child had but one hand, the right upper extremity terminating at the wrist.[55] I then learned, for the first time, that when the mother had been some time pregnant—(I could not learn the precise period, but suppose about three months)—her attention was strongly directed to the hand of an occasional visitor to the house, who had lost a part of it by an accident.[56] She could not help looking at it whenever an opportunity offered, and expressed to her nurse a fear that the child would be affected by it. The Nurse ridiculed the idea, as I might, and Dr. Richards doubtless would have done, and expressed her opinion that pregnancy was too far advanced for the mother's fancy to affect the Child. The result proved otherwise, and I leave it to Dr. Richards to reconcile this fact with his opinion."[57]

The foregoing Case was followed by Mr. Hamilton, of Ipswich, who, in a letter published in the "Lancet" of the 30th Nov., 1850, writes thus:—

"Seeing another Case by J. S. in your notices of Nov. 16, confirming the influence of the mother's mind on her future offspring, I herewith enclose you the outline of three of these cases occurring to me during the last forty years.

"I leave Dr. Richards and our modern Physiologists to explain, as they best can, this subject.

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[55] See Diagram 8, which represents the same kind of Deformity in both Hands.

[56] The Child born had *no Hand.* The supposed Cause was looking at *the* Hand of a visitor who had lost only "*a part of it.*" This Case illustrates the kind of resemblance which is considered sufficient to support this popular belief. The Child born was just like Diagram 8, also Cases, Nos. 174, 175, 176, 177, 178.

[57] "Lancet," November 16, 1850.

" The First Case was the Wife of a Gauger at Bramford, to which place she had recently removed, and in which a Dwarfish Woman had resided for many years, remarkable for the *Smallness of her Arms.* I delivered this man's wife in due time of a full-grown healthy babe, with the exception of *the absence of both arms from the shoulder joint.*[58] On seeing the child, the mother explained the matter, by acknowledging the surprise the first appearance of the above dwarf made on her mind in the early stage of gestation.

" The Second Case was a Mrs. J., residing in a neighbouring village, whom I delivered of a full-grown babe alive, but which died a few hours after birth. To my surprise, I found, on separating the cord, the whole or greater part of the small intestines protruding through a circular aperture adjoining the umbilicus.[59] These bowels exhibited a singular convoluted appearance, forming two or three circles round the opening, and held in their position by adhesion to the skin of the abdomen. The Mother, on seeing the Child, immediately explained the matter, by expressing the surprise she experienced one night in placing her hand on a cold plate of sausages in the dark pantry, in the early stage of pregnancy. The resemblance was so complete as, at once, to strike the female attendant.

" The Third Case was a Mrs. H., a neighbour, confined of a healthy female child, in due time, without a right arm,[60] having merely a rounded stump at the end of the scapula. This, she explained to me, arose from the fright she experienced by a mendicant coming into her shop, holding up the stump of the right arm. Mrs. H. gave him alms immediately to get rid of the sight; but felt so poorly that she was obliged to take a little brandy to recover the shock, accusing herself at the time for being so simple. This lady now informs me that this occurred during the first month of gestation, while suffering from gastric irritation.

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[58] The same Deformity as Cases, Nos. 174, 175, 176, 177, 178.

[59] See Case, No. 171, page 62, in which the Abdominal Wall was absent, and the Bowels protruding.

"Yours respectfully,

"W. Hamilton."

"*Ipswich, Nov.* 26, 1850."

The Cases which I have now quoted are quite sufficient for the purpose I have at present in view, *viz.*: to explain the kind of influence which it is believed can be exercised by fright, &c.; and to establish the fact that many members of the profession entertain a belief in the power of such a cause to produce Deformity, and even Monstrosity. I cannot, however, refrain from detaining you with the following remarkable account bearing upon this subject, also extracted from the "Lancet" of Nov. 17, 1849. It is headed "Something New (if true)." It is as follows:—

"A letter, of which the following is a copy, was published in a French provincial paper (Le Messager de la Haute Marne), on the 14th of October. It was addressed to the editor, and has been thought worthy of repetition by the Parisian press:—'Sir; Some days ago, I was called to attend a confinement at the farm of Combe aux Vaches, which forms, I believe, part of the Arrondissement of Langres. The young country woman (fermière), after a most painful labour, which lasted no less than twenty-four hours, gave birth to a female infant, perfectly formed, but having, at the extremity of the vertebral column, a fleshy appendage of about four to five inches long, and terminated by a real eye, covered with a thick eyelid. It was not until ten days after the birth of the infant that I was able to satisfy myself of the existence of this extraordinary eye. The pupil, though little dilated, appears to be gifted with great sensibility. At the slightest touch of the finest hair it instantly covers itself with a contractile membrane. I have ascertained that there is no sympathetic connexion between the two eyes of the head and that of the caudal appendage, which can remain open when the others are shut, and *vice versa.* It was not possible to conceal, for any length of time, from the mother, the existence of such a monstrosity. Happily, she was not so much concerned about it as they had feared. She confessed to us that, whilst in the family way she had read some book—of which she could neither tell the title nor the author's name—in which it was stated, that at a future period, people would all have an elongation of the spine in the form of a tail, at the end of which there would be an eye; and the idea had taken such a hold of her mind, that she had come at last to wish to see its fulfilment, on account of the great advantage of such a conformation. No doubt the anxious desire of the young mother, joined to the idea of a fervid imagination, had caused the production of this surprising phenomenon. For my part, I have always thought, although by no means a partizan of fanciful ideas, that desire and craving (besoin) are the sole causes of the generation of extraordinary organs, as was assumed by our great naturalist Lamarck. I have thought it right, Mr. Editor, to make known to the public a circumstance so unusual, which proves of what freaks nature is sometimes capable.

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[60] See Case 175, p. 64.

"Believe me, &c.,

"Ravot, M.D."

In the "Lancet" of the preceding week, Nov. 10, 1849, there had been an account of a race of men with tails existing in Central Africa, a report of which had been communicated to the Academie des Sciences, of Paris, by M. E. Du Couret. It runs as follows:—

"*Men with Tails.*—M. E. Du Couret, who has been for some time engaged in the exploring of Central Africa, has communicated to the Academie des Sciences, of Paris, some curious particulars of a race of Ghilanes, who possess the appendage of a tail about a decimetre in length. His description of the instance which he examined is as follows:—'To convince me of the existence of this species of man having this exterior prolongation of the vertebral column, the Emir sent for one of his slaves named Bellal, who was about thirty years of age, who possessed this tail, and who belonged to this race. This slave spoke Arabic perfectly, and was very intelligent. I examined him, and was perfectly convinced. He informed me that his country was beyond Sennear, through which he had passed; and that a language was there spoken which he had completely forgotten. He estimated the number of his race at about thirty or forty thousand. He said that they were cannibals, and that they worshipped, some the sun and moon, some the stars, others the serpent and the sources of a great river, to which they sacrificed their victims. He concludes his narrative by stating that it would not be difficult to procure some individuals of this race of men, by application to the slave merchants who explore the countries on the borders of the Red Sea."

I have adduced these last Cases, extracted from our *leading Medical Journal*, for the express purpose of illustrating the *amount of credulity* that exists upon this subject, and to exemplify the baneful influence that is exercised by the current belief that such things as "fright," "a passing thought, *which had been forgotten for months*," could "lop off two arms;" or that the sight of a dwarfish woman with *small* arms should cause the "*absence of both arms from the shoulder joint*;" or that the putting the hand on a plate of cold sausages in a dark pantry would induce the absorption of the abdominal walls, so that the bowels should protrude, and form two or three circles round the opening.

As I am certain that a belief in this doctrine is the cause of much unhappiness, and as I am a *total disbeliever* in its asserted potency myself, I enter upon its consideration in the hope that I may be able very materially to modify it, if not entirely to remove it from the minds of all such persons of intelligence as will seriously and *without prejudice* examine the subject. I will, therefore, now state to you the arguments that appear to me sufficient to warrant my entertaining such a hope. They are as follows:—

1stly. That the resemblance of the blemish or deformity to the form and appearance of the object which occasioned the fright, or to the article longed for, is so *imperfect*,[61] that it requires a stretch of the fancy to discover it; whereas, on the other hand, it exactly corresponds with the deformity in other cases in which there has been *no* fright.

2ndly. That this fancied resemblance of the blemish or deformity to the assigned cause is the sole bond of connexion between them, and, in fact, constitutes of itself the only point of seeming *evidence* upon which they are regarded in the light of cause and effect.

3rdly. That even this slight bond of connexion between the deformity and the assigned cause has nearly always *to be sought for* in the *memory of the mother*, *after* the blemish or deformity has been recognised, as it is hardly ever even so much as hinted at antecedently.

4thly. That there is no *proof*, either by analogy or otherwise, that the parent can either *add to* or *diminish* the power of development which exists in the ovum immediately after impregnation; whereas, on the contrary, there *is proof*, by analogy with the egg of the bird, as demonstrated in the preceding Lecture, that when *once development has commenced*, that the embryo animal is placed completely out of the *mental influence* of the parent.

5thly. That immediately upon the impregnation and liberation of the ovum from the ovary, and its reception by the fallopian tube, it (the ovum) has lost all *direct* communication with the *nervous* and *vascular* systems of the mother; and, for a given period, it is as much dependent for life and nutriment upon its *own* resources as the extruded egg of the bird, or of any other oviparous animal; *viz.*, on the impulse of development communicated at impregnation for life, and on its included yolk (Vitellus) for nutriment.

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[61] For example, in page 95. An arm without *hand and wrist* is considered like a hand merely deficient of a part. See Note 56.

6thly. That the ovum, on quitting the ovary of the human female, is as distinctly a *separate* portion of matter as the egg of the bird at the moment of its extrusion; and, moreover, notwithstanding its diminutive size ($\frac{1}{180}$ to $\frac{1}{240}$ of an inch),[62] the human ovum consists of parts that are perfectly equivalent to, if not absolutely identical with, those of the egg of the bird, with the single exception of the calcareous matter in the shell; thus it possesses (see Diagrams 53 and 54) an outer dense membrane (2) (the chorion)[63] which is equivalent to the membrane of the shell (membrana testæ) (2); a layer of albumen[64] between that membrane and the yolk (3) ; a vitellary membrane (4) enclosing the yolk (5) ; and a germinal vesicle (6) containing a germinal macula (7).

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[62] "The ripest ovum in the ovary of the human subject, and of the mammalia generally measures no more than from the fifteenth to the twentieth part of a line in diameter; it happens very rarely indeed, that they are seen so much as the tenth of a line in diameter; so that they are only to be distinguished with extreme difficulty with the naked eye."—*Elements of Phys., by R. Wagner, M.D.*, p. 44.

[63] "At the earliest periods at which human ova have yet been examined in the uterus,—and this has been when they were but of the size of a pea,—the CHORION has been found surrounding the embryo loosely as a simple membrane shut on all sides, smooth internally, rough from the presence of short cylindrical villi externally."—*Elements of Phys., by R. Wagner, M.D.*, p. 191.

[64] "In the first months of pregnancy, instead of the membrane now described, an albuminous mass of very various consistency is

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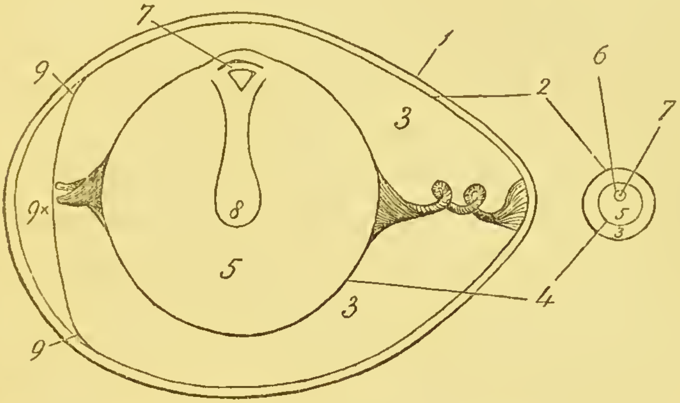

E. J. C.

53. Ideal Section of a Bird's Egg (after Waguer).
54. Ideal Section of a Human Ovum magnified 45 diameters (after Wharton Jones).
The Figures apply to each.
1, The Shell.
2, Membrane of the Shell, which at 9, at the blunt pole, splits into two layers to form the Space filled with Air, 9 × ;—in the Human Ovum 2 represents the Chorion.
3, Albumen between Membrane of Shell and Vitelline Membrane, or, in the Human Ovum, between the Chorion and Vitelline Membrane.
4, Vitelline Membrane.
5, Vitellus or Yolk.
6, Germinal Vesicle.
7, Germ.
8, Central Cavity in the Yolk, from which a canal leads to the Cicatricula.
9 ×, Space filled with Air.

7thly. That the ovum thus constituted, and distinctly separate from the maternal tissues, passes as such separate organism through the fallopian tube to the uterus, as to an *internal nest*, and on its arrival in

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found, often intermingled with numerous flocculi and threads, occasionally pulpy or gelatinous, and still oftener arachnoidal in its characters. . . . . This mass occupies the space, in young ova still considerable, which intervenes between the Amnion and Chorion. This matter or tissue has been designated by different names, and very commonly compared to the albumen of the egg of the bird and certain other animals."—*Elements of Phys., by R. Wagner, M.D.*, p. 193.

that nest it is *even then* altogether dependent on *accidental* circumstances as to the spot at which it will subsequently become arrested in its progress in the interior of the uterus, by the already formed (or forming) lining membrane of the uterus (the decidua vera) (see Diagram 62 and 63);—thus, it is well known that the ovum occasionally passes all down one entire side of the uterus, to its internal orifice, thus giving rise to the dangerous complication of labour known as placenta previa, instead of becoming attached close to the uterine orifice of the fallopian tube (see Diagram 77, in Lecture IV., in which this is the case).

8thly. That during the *in*definite period[65] the ovum, as a detached vesicle, is passing through the fallopian tube, and along the interior of the uterus to the spot to which it is to become attached, certain changes have commenced, and it has increased in bulk;[66] but this increase is either solely by imbibition[67] (endosmose) of the fluid which surrounded it in the fallopian tube, *or* by its own inherent power of development, inasmuch as the maternal vessels and nerves have been *merely* in simple *contact* (not united) with the outer (villous) surface of the external membrane (chorion) of the ovum, which membrane, as seen in Diagram 53 and 54, is the equivalent to the membrane of the shell in the bird, and is separated from the amnion, and contained embryo, by the albuminous space (see Diagrams 53, 55, and 56, fig. 3) ;—consequently here has been a *positive period of nearly a fortnight* (see Note 65) from the liberation of the ovum *from* the ovary *to* its attachment to the interior of the uterus, during which it (the ovum) has been a *completely detached* or isolated vesicle, *bathed in fluid* (see Note 66), and MOVING FROM SPOT TO SPOT, which *facts* absolutely forbid our entertaining for a moment the idea that a mental impression could be conveyed to it *in this stage* of its *progressive development*, unless we admit the possibility (which I do not) of conveying a *mental* impression from the mother to the offspring through *other* channels than the *nerves.*

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[65] Arrival of ova in the uterus—human:—"We possess also the recent record of two valuable observations made on the structure of the gravid uterus of females dying suddenly eight days after sexual intercourse; the one by Weber, the other by Professor Baer. No ovum was detected in either of these instances, either in the uterus or in the tubes. We feel inclined to place much reliance on these two observations, as being made by persons well acquainted with the various circumstances necessary to be attended to in such a delicate investigation, and with all the advantages of recent knowledge; and though they afford negative evidence only, yet we are disposed to found upon them, as proofs, that at the eighth day the ovum has not descended into the uterus."—*Allan Thomson, Art. Gen., Cyc. Anat. and Phys.*, p. 454.

Descent of ovum into uterus:—"......We would hazard the opinion that the human ovum arrives in the uterus on the eleventh or twelfth day after conception. Valentine thinks the twelfth or fourteenth day."—*Allan Thomson, Art. Gen., Cyc. Anat. & Phys.*, p. 454.

[66] "The ovum gains a little in size, too, during its progress through

9thly. That immediately after the ovum arrives in the uterus, the embryo begins to be visible in the

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the tube, perhaps by absorbing the fluid resembling thin albumen, which is shed into the tube at this time."—*Elements of Phys., by R. Wagner, M.D.*, p. 138.

[67] "The inquiries of British embryologists have shown the ovum to be the seat of very great and important changes, both before it is cast loose from the ovary, and *during its passage through the fallopian tube.*"—*Elements of Phys. by R. Wagner, M.D.*, p. 139.

germinal membrane (see Diagrams 55 & 56); and by the *third week* (*i. e.* after it has been in the uterus only from seven to ten days) it (the embryo) *is distinctly*

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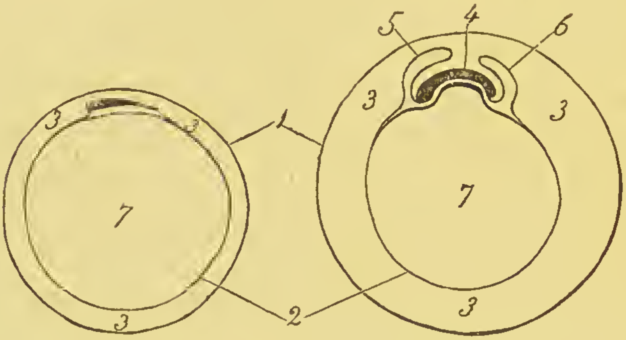

E. J. C.

(Copied from Wagner.)

55. Perpendicular Section of Human Ovum that had reached the Uterus immensely Magnified.
1, The Chorion.
2, The Vitellary Membrane surrounding the Vitellus.
3, The Albuminous Space, filled with Albuminous Tissue, separating the Embryo and Vitellus from the Chorion.
4, The Germ.
7, The Yolk.

56. Perpendicular Section of Human Ovum still further advanced, also immensely magnified.
1, The Chorion.
2, The Vitellary Membrane.
3, The Albuminous Space between Chorion and Amnion.
4, The Lamina Serosa, or Germ.
5, The Amnion from the Head (Involucrum Capitis) proceeding to unite with 6, another Fold of the same Membrane (Involucrum Caudæ), and to form, by their union, the Amniotic Cavity, as in 8, Figure 63.
7, Yolk.

separate from its OWN MEMBRANES, and hangs in a diminutive bag of water (see Diagrams 58 and 70) by a miniature funis (4) nearly as long as itself, which thread-like funis, becomes gradually longer and longer as Development progresses:—consequently, by the *third week* from impregnation, perhaps even a few days earlier, the embryo has become completely *isolated* or separated even from the outer membrane of the *ovum* (the chorion) (see Diagrams 56 and 58) by the

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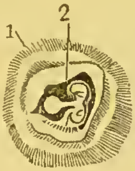

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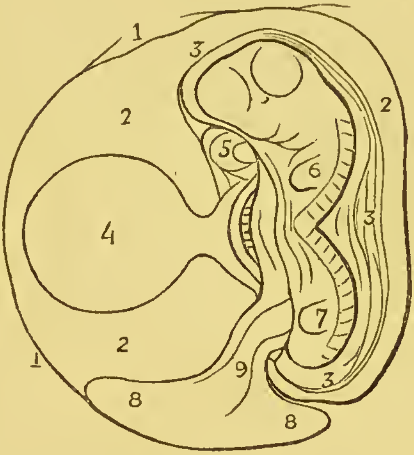

E. J. C.

(Copied from Wagner.)

57. "A perfectly Normal Human Ovum of the Third Week (about twenty-one days old) enclosed in the Decidua—Size of Nature.

58. "The same Ovum laid open; the Embryo about two lines long, closely surrounded by the Amnion and Chorion."

59. The same Ovum Magnified.
1, Chorion laid Open.
2, Albuminous Space betwixt the Amnion and Chorion.
3, Amnion closely surrounding the Embryo.
4, Umbilical Vesicle, communicating with the Ventricular Intestine.
5, Heart.
6, Anterior, and, 7, Posterior Extremities.
8, Lamina Vasculosa of the Allantois (subsequently the Placenta).
9, Lamina Mucosa of Allantois (subsequently the Bladder).

development of an albuminous and delicate arachnoidal tissue; and it is absolutely not until the extension of the *allantois* to the chorion, *in the third month*, that direct connexion exists between the *vessels* of the *embryo* and those of its *own outer envelope* (the chorion) (see Diagrams 60 and 61); here is, therefore, a *Second* Period, in which the embryo exists in a *detached* state, *viz.*, until the allantois unites to the chorion, during which *Second* Period, the only medium for the communication of a mental impression from the mother to the embryo has been, 1stly, the albuminous

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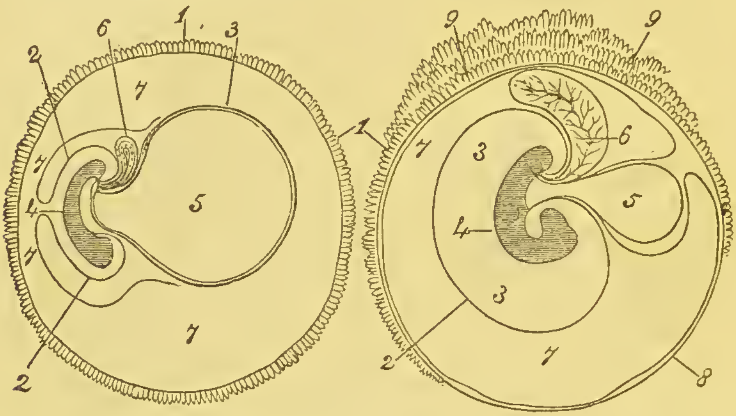

E. J. C.

(Copied from Wagner.)

60. "Human Ovum still further advanced."
1, The Chorion which has now produced Villi.
2, The Amnion (Involucrum Capitis) passing over the back of the Embryo to unite with the opposite portion (the Involucrum Caudæ).
3, The Lamina Vasculosa surrounding the Yolk (5).
4, The Embryo nearly enclosed by the Amnion.
5, The Umbilical Vesicle (Yolk).
6, The commencement of the Allantois.
7, The Albuminous Space separating the Embryo from the Chorion.

61. "The Human Ovum in a state of still greater Advancement."
1, The Chorion, which has its Villi now greatly developed at the part at which the Placenta will ultimately be formed. The portion marked 8 has now become smooth.
2, The Amnion. 3, Amniotic Space filled with Fluid.
4, The Embryo. 5, The Umbilical Vesicle (Yolk).
6, The Allantois, which has now reached the Chorion, and with it helping to form the Placenta.
7, The Albuminous Space separating the Amnion and its enclosed Embryo from the Chorion, except where the Allantois unites to the Chorion.
8, The Smooth Portion of the Chorion.
9, The Villi of the Chorion that are to form the Placenta.

and arachnoidal tissue (see Diagrams 55 to 61 inclusive) filling the space[68] between the chorion and the amnion;

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[68] "The embryo, together with the amnion and umbilical vesicle, do not occupy the entire cavity of the chorion; there still remains a considerable space which is filled with a delicate filamentous or arachnoidal tissue, occasionally also with an albuminous fluid, or a fluid that strongly resembles the vitreous humour of the eye."—*Elements of Phys., by R. Wagner, M.D.*, p. 166.

and, 2ndly, the fluid *within* the amnion, which has surrounded the embryo from the *third* week (see Diagrams 58, 61, and 70).

10thly. That the allantois, which is very *early* formed[69] in the human embryo (see Diagram 59 of the third week, in which it is figured 9) gradually passes off from the embryo, carrying with it the *umbilical arteries*[70] and *vein*, to coalesce and ramify on the inner surface (the endochorion) of a particular part of the chorion; which arteries and vein, ultimately (*i.e.* about the *third* month[71]), by their ramifying *on* and *in* the substance of a thickened mass of vessels formed by the villi of the chorion and the maternal vessels in the *decidua serotina*, known as the placenta (see Diagram 63), establish a communication between the mother and the offspring, *viz.*, the *perfect* umbilical cord[72] (see Diag. 63 and 70), by means of which the blood of the embryo can be purified *through the coats of the vessels* containing it, by the vessels being brought into

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[69] "In the human being it is only in the very earliest periods that traces of an allantois, can be discovered;" ...... "In embryos from a fortnight to three weeks old, in which the abdomen is still widely open, a pyriform bladder is seen springing from the lower extremity of the intestine, which contains vessels, and is directed towards the chorion."—*Elements of Phys., by R. Wagner, M.D.*, p. 197.

[70] In all the orders of mammalia ...... "an allantois has been found to be formed in a very similar manner; it arises as a small vesicle from the cloaca, and is speedily covered by a vascular lamina, carrying along with it, precisely as in birds, two umbilical arteries from the aorta, and two veins, which generally unite into a single trunk, and proceed as the umbilical vein to the vena cava."—*Elements of Phys., by R. Wagner*, p. 197.

[71] "At the beginning of the second, perhaps in the course of the first month, the villi (*of the chorion*) are observed to divide into branches ......whilst, in the part indicated, the dendritic villi are large, closely crowded together, and here coalesce in an especial manner with the decidua, pushing their ramifications into the thick stratum of the decidua *serotina;* in this manner, and in the course of the *third* month is the PLACENTA formed."—*Elem. of Phys. by R. Wagner. M.D.*, p. 192.

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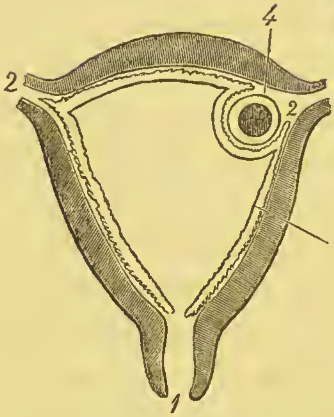

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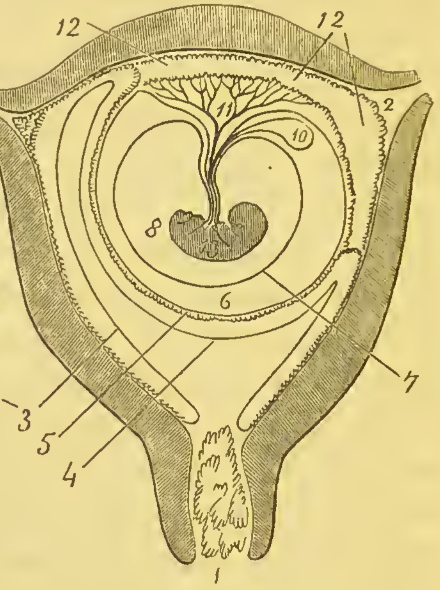

E. J. C.

(Copied from Wagner.)

62. Ideal Section of Uterus soon after the entrance of the Ovum :—
  1, Neck of the Uterus.
  2, Entrance of the Fallopian Tubes.
  3, Decidua Vera covering the Walls of the Uterus. On the right side, it enters into the Fallopian Tube ; on the left, it forms a pouch to surround the Ovum.
  4, The Outer Membrane (the Chorion) of the Ovum : between this and the Vitellus there is now a layer of Albumen separating the one from the other.

63. Ideal Section of the Uterus, and its Contents, in the Third Month.
  1, The Cervex Uteri plugged up with a Gelatinous Mass.
  2, Entrance of the Fallopian Tubes.
  3, Decidua Vera. On the right, it still fills up the Opening of the Fallopian Tube ; the left Fallopian Tube is closed by the Decidua Serotina (12).
  4, The Decidua Reflexa. 5, The Chorion.
  6, Albuminous Space between the Chorion and the Amnion.
  7, The Amnion surrounding the Embryo, and 8, the Amniotic Space.
  9, The Umbilical Cord. 10, The Umbilical Vesicle and its Pedicle.
  11, The Allantois uniting with the Decidua Serotina to form the Placenta.
  12, The Decidua Serotina. 13, The Embryo.

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[72] Perfect umbilical cord :—" The amnion is now widely separated from the embryo, which it surrounds as a capacious bladder ; it encloses the embryo anteriorly, and, investing the pedicle of the allantois and umbilical vesicle, forms the umbilical cord, which connects the embryo with the *allantois*, and even now (the fourth week) is often of greater length than the embryo itself."—*Elements of Phys. by R. Wagner, M.D.*, p. 168.

contact with the thin coats of the capacious capillaries in the placental[73] mass, after the manner that the blood is *purified* in the lungs *subsequently* to birth.

11thly. That on the *formation of the placenta*, the *umbilical cord* forms a direct connecting link between the maternal *substance* and that of the embryo; and *this cord* is generally regarded as the channel through which mental impressions can be conveyed from the mother to the offspring; *but*, that as *nerves*, which are the only *conceivable* means for *transmitting a mental or nervous impression* from the mother to the offspring, or, indeed, from one part of an animal to another part of the same animal,[74] *cannot be proved to exist*[75] in the umbilical cord, except within half an inch[76] of the fœtus, although the anatomical structure of the cord has been made the subject of careful investigation by the *most eminent* physiologists, it is clearly evident that it (the cord) is not anatomically constructed, *i.e.* developed, in a fit manner to perform *such* a function; and, therefore, that a *mental* impression cannot be conveyed by *such* a channel to the embryo *at all*, much less to a *particular part* of its frame, as the hand, or the foot, or head, or trunk, and thereby to effect a change in its development.

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[73] Placenta:—"At one part the ovum is covered neither by the decidua vera, nor by the decidua reflexa; this is where the placenta is formed; and usually indicates the point of reflexion of the decidua reflexa; here there is a thick stratum of a substance precisely similar to the decidua reflexa, which attaches the ovum to the wall of the uterus, and which blends intimately on the outer side of the reflex fold with the decidua vera: this thick stratum is named the *decidua serotina*, from its appearing to have been formed at a later period."—*Elements of Phys.*, *by R. Wagner, M.D.*,, p. 188.

[74] "It is generally believed that it is in the course of the *third* month, when the placenta is completely formed, that several considerable and even very important organs first make their appearance; these, however, are most probably present in a rudimentary state during the second month, but are overlooked. The chief of the organs that now become distinctly visible are the thymus, the spleen, the salivary glands, and the pancreas; the muscles, the *nerves*, the internal parts of the ear, and the ossicula auditus."—*Elements of Phys.*, *by R. Wagner, M.D.*, p. 176.

[75] Dr. Blundell, in the Lectures delivered at Guy's Hospital, 1828, says, "No nerves have been detected in the umbilical cord, although they have been sought for with great diligence; and I can state, from my own observation, that this part seems to be wholly destitute of sensibility in respect to both the mother and the fœtus. No large

12thly. That the general belief in the non-existence of nerves in the cord is borne out by the fact that the cord *commences in, and passes from, the embryo as early as the Third* Week (see Diagram 58), whereas nerves are *not developed* (see Note 74) *in the embryo* until between the *Second* and the *Third* Month, at which time all the exterior of the frame, such as the head, arms, hands, legs, and feet, are externally developed even to the fingers and toes, as may be seen in Diagram 64 of the Tenth Week.

13thly. That the belief in the non-existence of

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lymphatic trunks have been found there. There is reason to believe that lymphatics are wanting altogether in the placenta, and, therefore, we should not expect to find them in the funis."—*Lancet*, 1828–9, Nov., p. 161.

"Hunter says there are none."—*Ed. Med. & Surg. Journal*, No. 60, Oct., 1838, p. 257.

[76] Schott says, "If nerves are present, they are only found close to the fœtus."—*Ed. Med. & Surg. Journal*, No. 60, p. 287.

The reason that minute nerve fibres are found in the cord close to the fœtus *may be*, that they pass *from* the *fœtus* to the cord for the purpose of strengthening the attachment of the one to the other, &c. —E. J. C.

Nerves in the cord is further borne out by the fact, that neither the mother nor the child experiences the slightest pain upon the division of the funis, a fact that militates against *even the bare supposition* of the existence of nerves in that organ.

No. 64.

No. 65.

(Copied from Wagner. E. J. C.

64. Diagram of Human Fœtus of Tenth Week—Natural size.
65. The same magnified.

14thly. That the blood-vessels *in the placenta* are only in juxta-position with those of the uterus, not one of them passing continuously from the parent to the offspring,[77] and, therefore, *nervous* influence cannot be transmitted by the delicate nervous filaments ramifying upon the coats of the maternal vessels, which *might be imagined*, notwithstanding they cannot be proved to exist, were it not for the aforesaid want of continuity of tissue in the blood-vessels alluded to.

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[77] Vessels distinct in placenta:—"These embryonic vessels have nowhere any direct communication with the vessels of the mother; besides their own parietes the two sets of vessels have always a layer of the chorion interposed between them."—*Elements of Phys., by R. Wagner, M.D.*, p. 200.

15thly. That the physiological fact of the non-continuity of the maternal and fœtal or embryonic blood-vessels is further corroborated by the microscope, which demonstrates that the union of the maternal vessels with the fœtal, *much less the embryonic*, would be perfectly useless, inasmuch as the red globules of the *maternal* blood are far *too large*[78] to circulate within the capillary vessels of the offspring.

16thly. That in *extra* uterine fœtation in the human female, the fœtus may be matured and its limbs developed of their normal form, as sometimes seen, or, even abnormally as to form, *out of the uterus*, thus proving that even *the uterus itself* is not absolutely and indispensably necessary to the development of the fœtus. In fact, proving that it is only the internal nest in which nature intended the offspring to be matured up to a given point of development;[79] and, that like the egg of the bird, the human ovum is capable of development *out of that especial nest.*

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[78] "On the singular difference in the size of the blood globules in young embryos and adult individuals of the same kind, first observed by Dr. E. H. Weber and myself, see my contributions (*Beiträge, &c.*, 2 *tes. Heft. S.* 35). This difference deserves mention in this place, as it affords a new assurance against the existence of any direct communication between the vessels of the mother and those of the embryo."—*Elements of Phys., by R. Wagner, M.D.*, p. 213.

[79] In the kangaroo, for example, it is only for a very short time, and it is not even known now at *what time*, or in *what manner*, the im-

17thly. That in some rare cases of extra uterine development, the fœtus has been developed *even in the body of the male*, two instances of which occurring in the human being I cited in my last Lecture, and referred to the preparations themselves.[80]

18thly. That in the recorded cases of *extra uterine* development, there are many examples of the existence of deformity, such as club-foot, six fingers, three toes, &c., some of which I have already adduced.[81]

19thly. That in an immense majority of the cases stated to be the result of fright, &c., *the time of the occurrence of the fright, &c.*, assigned as the cause of the deformity *in no way corresponds with the period at which it is* NOW WELL KNOWN,[82] *from physiological investigations, the deformity first originated.* This reason I shall have occasion to enter more fully into presently, when discussing the next cause, *viz.*, "Arrest of Development."

20thly. That congenital deformities in the human being, and in all classes of animals, partake of a regularity of type,[83] as demonstrated in the last Lecture,

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perfectly developed and yet fœtal offspring becomes removed from the uterus into the abdominal pouch, in which it is found hanging to the nipple, which part of the mother is received into a groove in the imperfectly developed palate of the *fœtus*, as it may still be called.

[80] See p. 61, Lecture II. Cases 137 and 138.

[81] See p. 63, Lecture II. „ 157 „ 160.—— Were these from fright?

[82] See p. 122, Lecture III.

[83] For example, see Cases, Nos. 31, 34, 35, 36, 37, 40, and 139, in which the identical deformities exist in the human being, the snake, the fish, &c. Or again in Nos. 41, 47, 48, 60, 61, 140, and 141. Or again in Nos. 82, 85, 86, 89, 161, and 168. Or again in Nos. 102, 104, 118, and 182. Or again in No. 171, in which the abdominal parietes

p. 65, that proves most clearly that they proceed from the uniform action of a cause or causes that affect development *precisely in the same manner in all animals;* and, therefore, as it would be *ridiculous* to advance *mental emotion* as a cause of the excess or deficiency of parts in the *lower animals*, in whom such deformities are even more frequent than in man, it is surely *unphilosophical to ignore the causes acting in the lower animals, and attribute such abnormal development in man to a purely fanciful cause*, *in support of which not an argument can be brought* either from analogy or physiology, or, indeed, FROM ANY SOURCE THAT IS NOT ENTIRELY IMAGINATIVE.

21stly, and lastly. That the *death of the mother is not immediately followed by the death of the child*[84]—thus clearly establishing the fact that the *most severe nervous shock that can be suffered* is not *as such* imparted to the fœtus, and, therefore, proving that any minor shock, such as fright, could not, as narrated by Messrs. Davis and Hamilton, "lop off two arms,"[85] or "remove the head and shoulders," &c., as in Diagram 8.

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are absent, as in the imaginative case of the plate of cold sausages mentioned in p. 96.

[84] "Dr. Lever mentioned a singular fact at the last meeting of the Hunterian Society. He had seen two women lately who had died in the eighth month of pregnancy. *The children were both alive after the death of the mothers.* Both fathers refused permission to allow removal of the live children from the dead mothers by Cesarian section."—*Med Times*, p. 507, May 15, 1858. Mr. Edmund E. Hooper, of Queen's Road, Dalston, has recently informed me of a similar case in his own practice.

[85] The embryo of the fourth week (Diagram 70) exhibits the exact counterpart of such deformity as the normal condition at that stage of development, &c. &c.

That a belief in the efficiency of this cause should have maintained its ground among females, I am not at all surprised; because it is productive of a much greater consideration towards them during pregnancy, at which time they are less equal to the duties and offices of life, and because it, moreover, according to their rank in life, on the one hand, either procures for them, or, on the other, is an excuse for, a greater indulgence in the wishes and appetites.[86] Consequently, it indirectly effects an end, which, as far as its indulgence is proper, ought to be in all cases, and doubtless is, in most, the natural result of affectionate consideration and solicitude.

That mental emotion, arising from the action of the exciting or depressing passions, such as excessive anger, joy, fear, grief, &c., may *indirectly injure the fœtus in utero by exciting disease in the mother*, for example, inflammation of the womb, and thereby giving rise to congestion, and inflammation of *the placenta*, or to disease and even death of the fœtus itself, I do not deny: but I do deny that the influence of such passions can give rise to an action in the *mother* which is capable of *removing or altering the form or structure of a part of the fœtus after it is once developed*, either by causing its entire absorption, or by inducing excessive, irregular, or arrest of development, so *as to impress upon the fœtus, in any degree, the resemblance of the object by which the mental emotion was excited.*

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[86] The following remark was made by a lady, before whom I had made the remark that I hoped to be able to remove such a prejudicial idea, &c.:—"Oh, Mr. C., you should not do that; that's not right of you. It's the only chance they have, poor things!"

To the opinion just advanced, I admit no exception; but I can imagine that in those cases in which powerfully exciting or depressing emotions act *immediately before, or at the moment of conception*, i.e. *before development has commenced*, that such vivid emotions may possibly exert an influence upon the form, &c. of the future progeny, inasmuch as it is, at *that time*, the first impulse of its future development is communicated to the ovum:—Impregnation itself being, in fact, the first of the wonderful series of changes which the ovum has to pass through in its conversion into a separate being.

The conclusion at which we have, therefore, arrived with respect to this *popularly* assigned cause of congenital deformity, is as *un*satisfactory, as, in the two preceding causes it was the reverse; inasmuch as with the single exception just mentioned, in which its action is limited to a *very brief period*, there is not the *slightest ground for believing that it can exercise any influence whatever in the production of deformity.*[87]

I cannot pass from this subject, however, without narrating to you another case, because I am informed by a gentleman, in whose veracity I have every confidence, that it is positively true. It was as follows :—

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[87] I am happy to find that I am borne out in the opinion I have so firmly expressed to you by the author of the Article *Generation* in the "Cyclo. of Anat. and Phys." (Dr. Allan Thomson), and by Dr. Willis. the translator of "Wagner's Phys." Dr. Willis, in a note, p. 227, says, "I may be allowed to observe here, that I participate in the greatest degree in the thorough scepticism of the writer (Dr. Allan Thomson) upon many points; for example, that the imagination of the mother produces any permanent bodily impression upon the progeny .... by far the greater number of the data adduced in support of this popular belief will not bear investigation, and others admit of explanation very different from those given."

"A gentleman, accompanied by his wife, who was three months advanced in the family way, was driving in a chaise-cart along the road a few miles from town. Having arrived at a house where he wished to call on business, he left his wife sitting in the chaise alone. He had not long entered the house before he heard a scream, and, looking out of the window, beheld his wife in a state of violent excitement, and a man in a complete state of nudity getting into the vehicle. By the time he got out of the house, other parties, neighbours, had gone to the lady's help, and the man was being forced into a house close by. The man who had thus acted was insane, and had, unobserved, escaped from his attendants. The lady was very much shocked, and ill, after the occurrence; and fears were entertained by the lady and her friends, that her progeny would be in some way affected in consequence of the fright. The period of accouchment at length arrived, and my informant assures me that all his anticipations were realized, for the child was born *absolutely naked.*"

I fear that it will be considered that I have devoted too much time to the consideration of this subject; but I deemed it absolutely requisite, inasmuch as we have had it brought against the City Orthopædic Hospital,[88]

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[88] Copy of a letter received in reply to an application requesting support for the City Orthopædic Hospital, in which there was enclosed a few woodcuts representing some cases of club-foot, &c.

"Sir,— "21, *Cadogan Place, June* 15.

"The frightful portraits you have presented to my view cannot fail to excite the most painful and compassionate feelings, indeed they that we are doing a public injury, by bringing together so many cases of deformity, and promulgating a knowledge of them, thereby influencing by imagination the minds of sensitive females so as to occasion deformity in their offspring, but this is happily a mere supposition, as I have stated in page 94.

The next cause of congenital deformity to which I have to direct your attention, is "*Arrest of Development.*"

The consideration of this cause of deformity ought perhaps to have been associated with that of the first upon the table, *viz.*: "Error in the Primary Impulse of Development;" but I have preferred placing it by itself for this reason, that although it is true, the arrested development may in some cases, be the consequence of an error in the primary impulse; yet it must also be admitted, that occasionally it may and does proceed from other and totally different causes; and, as we shall see hereafter, the physiologist can determine with a degree of precision amounting to a certainty, the precise period at which it commenced its action.

It would be most interesting at this point of the inquiry to enter into an examination of the nature of the causes themselves, which are capable of exerting such

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are scarcely fit to be presented to the view of a sympathising and tender person; and if impressions on the inspection of such figures can be supposed dangerous to the formation of human figures in a state of impending existence, it cannot be too carefully concealed from their view. Under this feeling, I abstain from keeping them, having full employment for anything I have to spare in the service of my Maker.

"I am, Sir, your obedient Servant,

"H. EDGELL."

an influence upon the embryo; but it would be totally irrelevant to our present purpose, and, therefore, I must confine myself to the simple establishment of the fact, that such a cause, *viz.*, "Arrest of Development," is occasionally productive of deformities.

The Primary Impulse of Development, when once communicated to the ovum, causes a series of changes to take place in it by which it is converted into the embryo, and, in the human being, this embryo passes through various and successive stages of form and structure, which were formerly erroneously regarded as typically representing the form, &c. of the various classes of inferior animals,[89] until it arrives at a phase of development peculiarly its own; after which its parts become more and more developed until they have reached their perfectly normal character and form. The whole of which changes, as regards *external form*, are completed by about the Tenth Week (see Diagram 64).

In this passage through the various stages of development up to that of perfection, an arrest in the progressive formative development of a part sometimes occurs, although nutrition and growth in other respects proceeds;—hence a Deformity, or even a Monstrosity, is produced, which the physiologist will immediately refer to the *precise* period of existence at which the *Arrest* of Development occurred.

The cause of deformity now under consideration presents some points of especial interest in the present inquiry, inasmuch as we shall find that several of the perfectly *normal* conditions of the *embryo are those which constitute by their persistence* many of the more common varieties of deformity, some of which varieties could not otherwise be explained in anything like a satisfactory manner. For example—a trunk without limbs, as noticed in the Note to page 15; or of a hand without fingers, or a foot without toes, as seen in Diagram 10, the latter of which is fully explained in Diagram 67, &c., representing the fœtus of the Seventh Week, in which the hand and foot are *normally without* fingers and toes; or of a deficiency of length in the limbs, as seen in No. 181[90] of the cases selected from the Museum of the Royal College of Surgeons, in which the feet and hands are close to the body: all which instances are merely *Transient Normal Forms* through which the embryo passes in all cases between the Third and the Tenth Week of it progressive development[91], which *Transient* Normal Form

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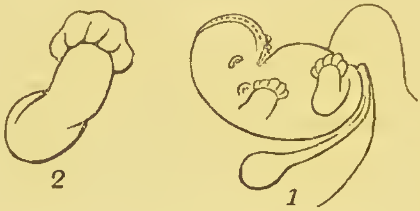
[89] See Diagrams 54, 55, 56, 58, 60, and 61, of human ova; and Diagrams 62 and 63 of the uterus and ovum.

No. 66. No. 67. No. 68.



(Copied from Wagner.)

E. J. C.

66, 67, and 68. Drawing of a Human Embryo, taken from the Uterus of a Woman who had committed suicide in the *Seventh* Week of Pregnancy.

1, Natural Size.
2, Anterior Extremity Magnified, showing the Hand without Fingers.
3, Posterior Extremity Magnified, showing the Foot without Toes.

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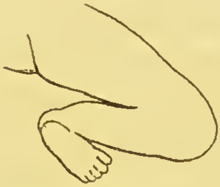
[90] See Diagram 70, p. 126, and Note 9.

[91] See Diagram 58, p. 107;—ditto 61, p. 108;—ditto 64, p. 113.—Nos. 174 to 181 inclusive, of Cases, p. 64.

had been *permanently* affixed to the child by the *Arrest* of the further formative development of the part, thereby converting the transient form into an absolute deformity.

Of these progressive stages of development through which the embryo passes, there is one which more than any other deserves our especial attention in connection with the present subject, as it corresponds in every respect with the most common form of congenital club-foot. The condition of the embryo, to which I have just alluded, exists in *every* instance from the *Second* to *the Fourth* or Fifth Month, or *even later;* and it is so constant that Wagner, in his work on Physiology, gives an illustration of the appearance of the embryo at that period, of which the Diagram is a copy (see Diagram 69); and *he* observes: "*The Club-Footed appearance that appertains to all Embryos is remarkable.*"

No. 69.



(Copied from Wagner.) E. J. C.

69. The Left Thigh and Foot of a Normal Human Embryo or Fœtus of the Fourth Month of the natural size.

In the instance just quoted from Wagner, the embryo, although perfect in form *as an embryo*, *is absolutely deformed* as compared with a *child at birth*, and such is its condition for at least *one-third* of the period of uterine existence; but notwithstanding this, under ordinary circumstances, the development of the antagonistic muscles in the legs and feet proceeds equally, so that at the completion of the process, neither the one nor the other is possessed of an excess of power or of length over its natural opponent.

Although the above is the normal consequence of development, it occasionally happens that the muscles on the concave *or apparently contracted* side of the limb, are *really arrested* in their growth *for a brief period*, after which development is re-established. During this period, however brief, the muscles on the opposite or extended side of the member, have become progressively enlarged, and hence an inequality of length is permanently established between the muscles of the limb, which can never afterwards be readjusted.

Whenever this temporary arrest of development accrues, the muscles so impeded or arrested in their growth, remain permanently *diminished*, by a portion of their substance equivalent in length and bulk to the *increase* which their *antagonists* have acquired during the existence of the impediment; and therefore it converts the apparent contraction of the tarsus in the embryo of the Second, Third, Fourth, or Fifth Month, previously alluded to by Wagner, as *simulating* club-foot, into a positive case of deformity, and the child will consequently be born with congenital club-foot. In this case the deformity is nothing more than the *persistence* of a *perfectly natural position of the embryo*, in consequence of an arrest of the development in one or more of the muscles of the leg or foot.

As I have now afforded ample proof of the occasional existence of an arrested development in the ovum or the embryo, and that some of the more common varieties of congenital deformity result therefrom, it is my duty now to proceed to the consideration of the next cause upon my table, *viz.*, Mechanical Interference with the Movements of the Embryo or Fœtus.

The whole of the causes of deformity which have hitherto occupied our attention, have *originated within the ovum or the embryo ;* but those which I am now about to bring under your notice are such as possess the power, *in the absence of all the preceding*, to exercise an injurious influence upon the embryo or fœtus, by exerting a force *from without, i. e.*, physically or mechanically.

When the human ovum first reaches the uterus, it is so small that it is scarcely appreciable to the naked eye (see Note 62; and for its magnified appearance, see Diagrams 46, 47, and 48), its diameter varying from the $\frac{1}{180}$ to the $\frac{1}{240}$ of an inch, the largest size recorded being only the $\frac{1}{120}$ of an inch, and to all appearance it is a mere vesicle,[92] laying upon some spot of the previously prepared inner surface of the uterus,[93] to which spot it quickly becomes attached. At this period, therefore, the *diminutive* size of the ovum is its *protection* against internal mechanical injury.

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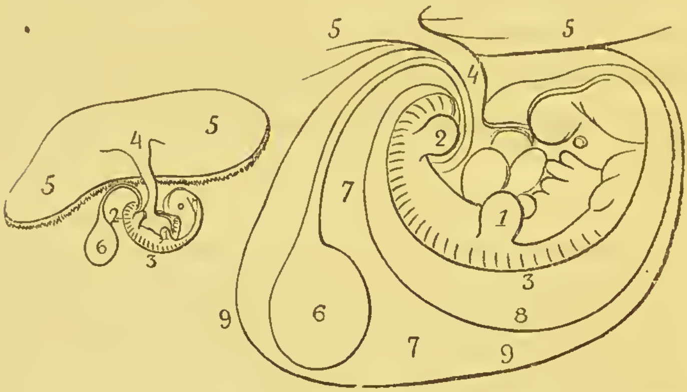
[92] The ovum of the human being is so minute, and the subject so beset with difficulties, that even some of our first physiologists have been deceived; thus Professor Owen states, in a Note to page 137, vol. v. of the Physiological Series of the Catalogue of the Mus. of the R. C. of S., that Mr. Clift asserts, that the human ovum described in the following quotation (from the *Phil. Trans.*, vol. cviii. p. 61) was only the ovum of a flesh fly deposited on the ovary during its dissection.

"This important discovery was made by Sir Everard Homo and Mr. Bauer. Upon examining the body of a young woman twenty years of age, with a perfect hymen, a corpus luteum was found in one of the ovaria; the ovum which it contained was an oval substance $\frac{15}{200}$ of an inch in length, less than $\frac{5}{200}$ in breadth, something contracted the centre, transparent, imperfectly covered by a membrane, by which it adhered to the corpus luteum."

[93] See Diagrams 62 and 63.

The vesicular appearance, however, of the ovum to which I have alluded, soon disappears, from the conversion of the ovum into an embryo with its membranes; and as development now progresses rapidly, the embryo, by the third week, acquires a length of about a sixth part of an inch (see Diagram 58). Moreover, it is entirely detached from its own membrane, and floats suspended by its rudimentary funis in the midst of the surrounding liquor amnii (see Diagrams 58 and 70), which effectually protect it from *pressure* or *concussion* during the movements of the mother.

No. 70. No. 71.



(Copied from Wagner.) E. J. C.

"A very beautiful Embryo figured and described by Jo Müller in 'Meckels Archiv.,' 1830, table xi." . . . "I regard it as about Twenty-eight Days old."

70. Natural Size. 71. Magnified View.

1, Anterior Extremity.
2, Posterior Extremity.
3, Markings of Vertebræ.
4, Umbilical Cord.
5, Point where the Allantois and Chorion have coalesced (subsequently to form the Placenta).
6, Umbilical Vesicle and its Pedicle.
7, Albuminous Space betwixt the Amnion and Chorion.
8, Amnion.
9, Inner Surface of Chorion laid Open.

From the moment the embryo floats thus loosely in the liquor amnii, we may consider it as a separate portion of matter, capable of being acted upon by external forces, *i. e.*, mechanically; and we may, therefore, proceed to enquire into the nature of the forces which may be brought to bear upon it under ordinary circumstances in its circumscribed position, so as to lead to the production of any degree of deformity.

Under ordinary circumstances, the thread-like funis alluded to, increases in thickness and in length as development progresses in the embryo, so that at the full period of gestation it has acquired a thickness nearly equal to that of a *man's little finger*, and its length averages about eighteen inches;—the increase in its diameter having been regulated by the increase in the calibre of the vein and arteries contained within it, through which the blood is transmitted to, and received back from, the embryo to the placenta;—but the increase *in length* appears to be a mere matter of *accident*, or to be regulated by no known fixed laws, in consequence of which, at the full period of gestation, it is sometimes not longer than two or three inches, whereas, in other cases, it has been known to have acquired the length of five feet.

In a paper published by Dr. Churchill, on the Umbilical Cord in the Human Subject, in the "Edinburgh Medical and Surgical Journal," Oct. 1838, he brings forward the following instances of extreme variation in its length, and appends the authority of each, *viz.*—

"Dr. Davis says, that a cord of two inches long has been met with; Guillemot, one of two-and-a-half inches; Montault, one of four inches; Meisner, one of five inches; Mauriceau, Baudelocque, and Morlani, one of six inches; Haighton, one of seven inches; Dr. Montgomery, two of eight or nine inches; Dr. Hamilton, one of six inches.

"On the other hand, M. Baudelocque saw one forty-six inches; M. Heritier, one of fifty-seven inches, which was coiled *five times round the neck;* Morlani, one of five feet; Dezeimeris, *one of twenty-eight inches in a fœtus of only four months;* and Velpeau, one of thirty-one inches in a fœtus at six months."

In addition to the list that I have just read, I may mention, that Dr. Tyler Smith, on the 10th January, 1850, presented to the Westminster Medical Society a specimen of a cord which measured fifty-nine-and-a-half inches.

Although we cannot enter into and explain every mode in which the extreme variations in the length of the funis can exercise an injurious influence upon the condition of the embryo, or in the later months upon the fœtus, we can demonstrate, that in some cases it does exert a positive and baneful influence, and that it is the direct agent of deformity, and even of monstrosity.

The mode in which the umbilical cord exerts this baneful influence is illustrated by the accident which occasionally happens[94] during labour, when *one or more* coils of the cord are found around the neck of the child (see Diagram 72), drawn with variable degrees of tightness, according to the length of the funis; sometimes slack, and exerting no injurious effect; at others tight, and retarding the delivery, or even causing the death of the child.

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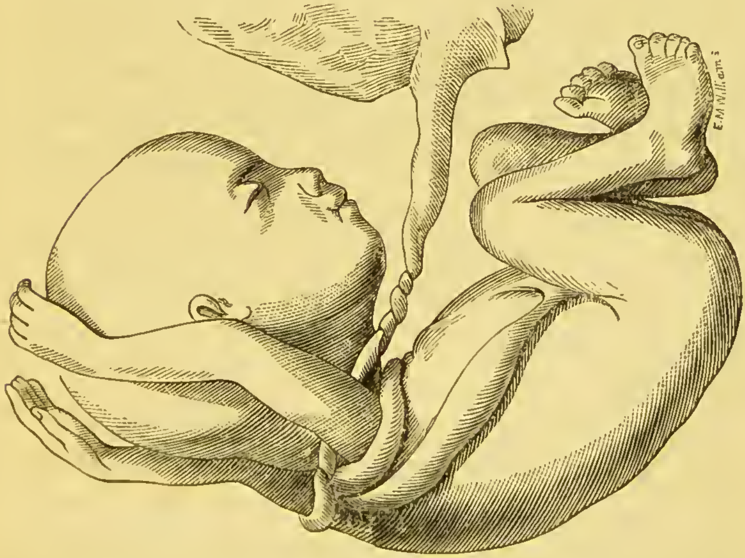
[94] "Out of 1271 Case I have already enumerated, there were 174 examples of this disposition of the cord, or rather more than one in seven."—*Dr. Churchill, Ed Med. Surg. Journal*, p. 293. Oct. 1838.

As this accident can occur to the full-grown fœtus, we can be under no difficulty in admitting the probability of its occurrence at any of the previous stages of development, in each of which the *relative proportions* of the *fluid* in which the embryo floats, as compared with its *bulk*, is greater than it is during the latter period, and therefore the freedom with which it moves or turns itself about is proportionally greater in the early stages than afterwards.

The occurrence of the coils of the cord around the

No. 72.



72. Diagram of a Fœtus with the Umbilical Cord twisted around the neck and arms. N.B. This *could not* cause *amputation of* the *arms*, inasmuch as the requisite compression would have arrested the current of blood, and therefore *caused death.*

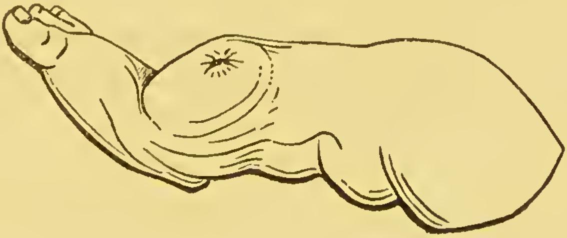
embryo or fœtus is easily explained, and, indeed, imitated; thus, if you suspend anything by a piece of string, and then twist it round two or three times, and afterwards place it so that the weight of the suspended substance is taken off the string, the string immediately *forms coils of itself.* As we know for certain, that the embryo *floats* in the liquor amnii, every motion of the mother must affect it, and cause it to be turned on its suspending cord, thereby twisting it; therefore, if the mother now reclines, and the cord is *sufficiently long* to permit the embryo or fœtus to repose on the side of the amniotic cavity, in that case one or more coils would immediately result, which would untwist again as soon as a change in the position of the mother permitted the embryo again to float in the fluid, provided the coil had not passed over one of the limbs, or the neck of the fœtus.

When this accidental coiling of the cord occurs during the early periods of development, one or more coils may be twisted around the neck, the arm, the leg, &c., of the fœtus (as seen in Diagram 72), and become more and more tightened as development advances, so that injury to the part results according to the degree of tightness with which the cord is wound around it, and the time it has existed; in some cases producing a mere indentation; in others a deep groove; or in more severe cases still, the limb becomes curved or arrested in its development, instances of all which deformities have fallen under my own notice, and casts of some of them I have preserved.

The effect produced by the cord in all these cases, is that of mere obstructive interference with the functions and development of the part round which it is applied, and if that interference is limited to the confining one or more of the limbs in a given position during the early months of gestation, *i. e.*, during the period at which its muscles and cartilaginous representatives of the bones are *developed*, without producing sufficient constriction to interfere with the current of the blood in the part, it may thus give rise to curvatures of the bones, and to all those deformities which can in any way occur from constrained position.

Of the first-named species of deformity, *viz.*, Congenital curvature of the long bones, many most interesting cases have come under my notice. The situation of the curve is usually about the lower third of the leg, and frequently there is an indentation, or little pit resembling a cicatrix, situated on the apex of the projection of the tibia, thus giving all the appearance as if at some anterior time, the bone had been protruded through the skin.[95] This appearance is well seen in Diagram 73, of a child a year-and-a-

No. 73.



73. The Leg of an Infant with Congenital Curvature of the Tibia and Fibula. On the apex of the curve there is a cicatrix, as if there had been a compound fracture. This is also an instance of Congenital Talipes Valgus, and also of Deficiency of the Toes, of which there are only three.

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[95] See Note, end of Lecture IV. for the possibility of this Case.

half old. The child was examined immediately after birth, by the surgeon engaged to attend the case, and more particularly so, because he did not arrive until after the child was born. At first sight, he considered the child had been injured in the birth, but on careful examination he noticed the indentation on the front of the leg, which at that time was larger in proportion to the size of the leg than it was when the cast was taken, and it had more the appearance of a recent cicatrix; and from these facts he arrived at the conclusion, that the leg had been fractured at some antecedent period, and *united at an angle* before birth. It is possible that the conclusion arrived at was correct, and that the bones had been fractured; but I am myself more disposed to regard it as a severe curvature only, and the indentation as the result of pressure on the inner surface of the skin, inducing inflammation and adhesion to the periosteum over the most prominent part of the Tibia, in which opinion I am borne out by the case of a child that was brought to me when only seven weeks old, for contraction of the legs on the thighs. The right leg of this child was bent nearly to a right angle, at the same part and in the same manner as the leg in the preceding case, and in this case there was the absolute proof that it was caused by a ligature of the funis, as the child was born with *the funis* coiled twice round its legs, in such a manner that it *could not be unwound until it was drawn from beneath one of the feet.* The limbs were thus firmly confined in a fixed position, and the foot and lower part of the leg bent round the other, thus *demonstrating* that the curvature in the bones of the leg was the *direct result* of mechanical force during its development.

In the foregoing cases, the curvature was from before backward, as seen in Diagrams 73 and 74 ; but I have seen cases in which it has been to one or the other side, and sometimes of a severe character.

In one of these more severe cases, the tibia and fibula of the left leg were both so much curved inwards at their lower third, that the foot was turned up against the inside of the calf, the great toe reaching nearly to the knee, giving rise to the appearance of a severe case of Club-foot (varus), from which, however, it differed in the fact that the tarsus was not in any degree abnormally articulated to the tibia and fibula, nor the bones of the tarsus in any way

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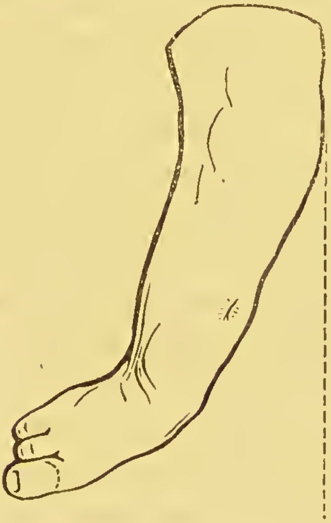

74. Outline of an Infant's Leg, with congenital curvature of the tibia and fibula the lower third. In this case there is also a cicatrix or indentation on the apex of the curve. 2ndly, It is an example of Congenital Genu Valgum. The dotted Lines are added to show the amount of deviation. And, 3rdly, This is another instance of deficiency of Toes, as there areb ut three as in No. 73.

misplaced, as regards their position to each other;—consequently, the whole of the deformity resulted from the simple but severe curvature of the tibia and fibula.

The funis, however, is not the only part capable of exerting this kind of influence upon the fœtus, inasmuch as *thread-like* bands are occasionally developed from some part of the fœtus itself or of its membranes, as the result doubtless of inflammation at an early stage, causing the deposition of fibrinous lymph, and the agglutination of parts together, which parts become again separated by the motions of the fœtus acting upon the spot of deposited fibrine, and thereby stretching it into a thread or band, in the same manner as the elongated bands are formed in old pleuritic cases.

In whatever manner these bands are formed, whether as I have stated or not, it is quite certain they occasionally exist, and exercise a baneful influence upon the embryo and fœtus; and as these bands are more dense in their structure, and smaller in calibre than the umbilical cord, the constriction exerted by them around any given part of the embryo or fœtus, is far greater than the funis can possibly effect, in consequence of the situation of the umbilical *vessels* in its substance, as such a degree of force would entirely arrest the *current of blood* through those *vessels* and cause the *death* of the embryo or fœtus.

That these membranous bands occasionally exercise a great amount of constriction there is plenty of absolute proof, some of which has fallen under my own immediate observation, and one or two instances of the kind I will therefore append;—those, however, who desire further information and cases of this variety of deformity, will find it fully treated in the article "Fœtus," in the Encyclopedia of Anatomy and Physiology.

The first case of deformity resulting from the injurious effect of constriction from membranous bands that I wish to adduce, afforded the positive proof that it arose from such a cause. In this case the child was born with imperfectly-formed fingers on one hand, and each finger was united to the adjoining fingers by a thread-like band which it *was necessary to cut asunder in order to liberate them from each other*;—moreover, two of the fingers had the extreme phalanges imperfectly formed, an imperfection that I have no doubt was caused by these bands constituting an absolute impediment to their proper development.

In a second case, but in this there was not the absolute proof of the presence of these thread-like bands as in the former, there was a deficiency of part of the fore arms. The arms appear as if each hand had been amputated[96] immediately above the wrist (see Diagram 8 of the Case, p. 15). There is no distinct cicatrix, but the skin is puckered a little in three places, and these spots appear like dimples in certain movements of the arms. There is perfect motion at the elbow joint, and the child can hold anything between the stump and the upper arm. The mother's explanation of the cause;—*for she* deemed it *necessary to assign one*—was that "it might be from her having seen a boy playing who had only a part of a hand and who attracted her attention from the peculiar mode of winding up his top—she was then three months gone in the family way." Or—"she had often thought it might be from thinking of her eldest son who was in the Baltic." We will not enter into the consideration of the cause assigned by the mother at the present moment, because we have already examined that cause in all its bearings in the last Lecture.

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[96] The amputated *part* is sometimes expelled at the time of birth with the maimed child.—*Vide Cyclo. of Anat. and Phys. Art.* "*Fœtus.*"

In the case just narrated there is certainly no direct proof that the deformity was the result of membranous bands, but the appearance of the stumps so corresponded with the appearance that a stump would have if the part had been amputated in such a manner, that it is difficult to arrive at any other conclusion as to its inducing cause: and this opinion is borne out by a case that was brought to me in 1854 for club-foot; *but besides* this the leg was amputated quite down to the bone (see Diagram 75) and the *cheek on each side* of the mouth was *deeply* indented by a groove or notch, that nearly passed through into the mouth. It was quite evident that a ligature, *and a ligature only*, could have produced these marks on the cheeks, and the partial amputation of the left leg; but in this case there was also an absolute *proof* afforded, as the toes of the right foot were united

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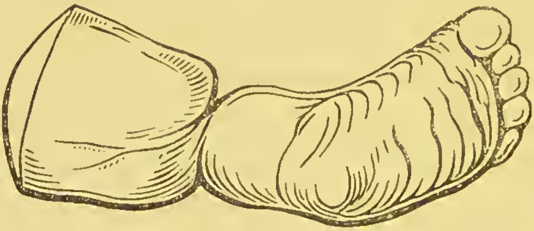

E. J. C.

75. Outline drawing of the Leg and Foot of a Child, in which partial amputation had been produced by a ligature before Birth. The indentation is down to the bones.

together at their apices *by a membranous band*, moreover two of them were united together quite to the top (webbed), and somewhat abortive, like the imperfectly formed fingers mentioned in page 87, which fingers were also united by a membranous band across their tips.

The formation of these thread-like bands, however, is not the only effect produced by inflammation of the membranes of the ovum, inasmuch as adhesion of the membranes, or of the placenta, to some part of the embryo, occasionally results therefrom, thereby materially interfering with its development, and occasionally leading to the production of deformity. The cases thus produced are generally such as fall under the class of monstrosities, rather than within the range of the term deformity as limited by our definition, for which reason I need not enter into their examination.

That inflammation of the membranes of the ovum is capable of giving rise to deformity, and even to absolute monstrosity, by their adhesion to some part of the body of the embryo or fœtus, is a matter well known, as numerous cases have been recorded in which the adhesion and the deformity or monstrosity have co-existed at birth.

There is, however, one point connected with this cause which is worthy of our especial consideration, *viz.*, that the adhesions,[97] whether of the placenta, membranes, or membranous bands which had occasioned the deformity or monstrosity may *be ruptured previously to birth*, and *leave not a trace behind by which you can recognize the seat of their former existence.*

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[97] See *Ed. Med. Sur. Jour.*, No. 50, p. 278. Paper by Prof. Simpson.

SYNOPSIS OF LECTURE IV.

Continuation of the consideration of the fourth reputed Cause of Mechanical Interference, *viz.*, "Position in Utero"—Division of the inquiry into two heads, 1stly, to ascertain whether the Uterus, under any circumstance, can exercise a degree of positive constriction upon the Fœtus; and if so, to determine the nature of the circumstances under which the Uterus can so act, and the period during which it can exert such an influence—2ndly, *Admitting* the existence of such a state of constriction, to inquire whether that state would of itself exercise sufficient influence to produce Deformity—Consideration of the last Cause of Congenital Deformity, *viz.*, Disease.

LECTURE IV.

CONTINUATION OF THE CAUSES OF CONGENITAL DEFORMITIES.

THE mechanical interference with the movements, &c., of the fœtus of which we have as yet taken cognizance, has been caused by constriction from a ligature accidentally entangled around one or more of its parts;—we have now, however, to enter upon the consideration of a mode in which it is stated by some authors that constriction of a very different kind can be exercised, *viz.*, by the uterus itself performing the part of a broad ligature, thereby confining one or more of the parts of the fœtus, as for example the hand, or the foot, in an unusual, and unnatural position for such an extended period of time, that irregular development of the muscles, &c., and consequent deformity is the result. The cases occurring from this cause are said to arise from "Position in Utero."

That I may not mistake the views of the authors to whom I have alluded, I will quote their own words—thus, Dr. Little says[98] — "This deformity (Talipes Calcaneo Valgus) has more than any other served to convince the author that, besides distortions from muscular action, some congenital distortions may be produced by pressure of some kind in utero. Perhaps in this instance the etiological cause was impaction of a large child in a restricted space, the long mechanical retention of the part in an abnormal position having induced secondary preponderant action of the abductors and anterior muscles of the ankle."

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[98] On the Nature and Treatment of Deformities, 1843, p. 314

Mr. Tamplin also in his work[99] remarks, page 48—"Lastly, as regards the position in utero; this I think the most probable cause," . . . . . . "therefore, so far as I can judge, I certainly am inclined to regard the exciting cause of the deformity as arising from the position in utero." Again, page 70, Mr. Tamplin remarks—"With regard to the congenital form of the deformity, I have told you in my last lecture, that in my opinion, it is position in utero, and position alone, which occasions this kind of deformity (talipes valgus) as well as other congenital deformities that exist without malformation." Again, page 111, "The deformity (genu valgum) is noncongenital;—at least, I have never seen a congenital case,[100] nor can I imagine how it could occur, *provided we admit that congenital distortions arise from malposition in utero*."

For this kind of constriction to be exercised, it is essentially necessary that the fœtus should so fill the cavity of the uterus, that flexion or extension of a given part is entirely prevented by the compression exercised upon it in every direction by the walls of the uterus; in fact, that the fœtus cannot perform such movements from the insufficiency of the enclosing space, and consequently that the fœtus must be rolled as it were into a ball, with its limbs doubled upon its trunk. Moreover, it must be *permanently* retained in such position without the possibility of alteration, until delivery is accomplished;—for, if this *fixed* state does not absolutely exist, *i.e.*, if there be any portion of space in which the fœtus can extend or flex the part especially constricted; or, if it can alter its general position so as to form a space in which the position of the constrained part can be varied, the effect of constriction would be lost altogether, and therefore the production of deformity in such a manner would be an impossibility.

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[99] Lectures on the Nature and Treatment of Deformities, by R. W. Tamplin, p. 111.

[100] That Genu Valgum is sometimes congenital, see Diagram 74.

In our investigation of the mode in which this assigned cause of deformity can act, it will be expedient for us to divide its consideration into two heads, *viz.*—

1stly. To investigate whether the uterus, under any circumstances, can exercise such a kind and degree of constriction upon the fœtus as to arrest flexion and extension of a given part; and if so, to determine the nature of the circumstances under which it can so act, and the period during which they exert their influence.

2ndly. Admitting the existence of such a state of constriction or pure want of room, to enquire whether that state would of itself exercise sufficient influence to produce deformity.

Let us, therefore, proceed to examine each of these points separately.

From the moment development has advanced sufficiently for the production of the umbilical cord, which period arrives as we have already seen about the third week of uterine life (see Diag. 58 and 70), the embryo hangs suspended in the midst of the surrounding fluid.

At this early period of gestation, the bulk of the fluid is considerably greater than that of the embryo; but this relative proportion becomes changed from week to week, and, indeed, from day to day, as the embryo gradually increases in size, until the period of utero-gestation is completed, at which time the former relative proportion between them is entirely reversed, the fœtus occupying a far greater space within the cavity of the uterus than the fluid;—in the first case the embryo is not more than ¼ of an inch long, or about as large as a small house-fly, and it is surrounded by a mass of fluid larger than a hazel-nut, the weight of which is many times greater than that of the embryo; whereas in the last named instance, the then fully developed fœtus weighs on an average from 7 to 9 pounds (according as it is male or female), and the long diameter of the oval figure, which it assumes, measures about ten inches, while the fluid is only upon an average about three pints; *but, observe*, that in either of these cases the fluid, notwithstanding the difference in its relative proportions, performs the same important office, *viz.*, the *equalization of the pressure* of the natural tonic contraction of the uterus, as well as the pressure from other parts, upon the fœtus, upon the cord, and upon the placenta, and thus establishes the condition necessary for the circulation of the blood; and, moreover, it also permits of the various movements of the fœtus, that in all probability are requisite for the due development of its members, which movements, whether requisite or not, would be *otherwise* impossible.

As the relative proportion between the fluid and the embryo commences with so great a preponderance of the former and gradually changes according to the development of the latter; and, as the effect of the fluid is to cause an equalization of the pressure upon the surface of the fœtus and its appendages, and also to permit of the requisite movements; it follows that injurious compression of an *individual part* cannot possibly take place until the relative proportion between the fluid and the fœtus has become so changed by the growth of the latter or by other causes, that it extends through the bulk of the fluid and presses against the internal walls of the uterus, on at *least two* of the opposing surfaces, sufficiently firmly to overcome entirely the power of flexion or of extension of its members, and therefore, as these are the only conditions under which injurious compression can be exercised by the uterus, we have now to enquire whether such an amount of alteration between the fœtus and the liquor amnii as that specified above *ever* exists; or an amount in any degree approaching thereto; and if so, to determine the circumstances leading to such an alteration; and to ascertain the period during which such injurious compression or constriction can exercise its baneful influence.

Although the ordinary proportions between the embryo or fœtus, and the liquor amnii at the different months of gestation is not distinctly specified in works upon Midwifery generally, nevertheless, we are indirectly enabled by their aid to arrive at the information we desire, sufficiently accurate for our present purpose, inasmuch as in some of those works figures are appended which had been drawn from actual admeasurements at different periods of gestation of the uterus and of its contents, consequently in these instances the true ordinary relative proportions between the embryo or fœtus and the liquor amnii can be immediately ascertained by comparing the size of the embryo or fœtus with that of the cavity in which it and the fluid were conjointly contained.

Upon reference to the splendid work of William Hunter upon the Human Gravid Uterus, the plates of which were all drawn from nature, you will find that the size of the embryo in comparison with that of the containing cavity varies considerably in the different months of gestation. Diagrams 76 and 77 are faithful copies from this work of the sixth and ninth months.

By examination of Diag. 58 and 63, or by reference to the original plates, you will observe that at the second month the embryo is seen at the bottom of the containing cavity, occupying not more than about the eighth part of the enclosing space; and the liquor amnii, therefore, exceeds it many times in bulk.

At the third month the whole contents of the uterus have become very much increased in size, and their relative proportions greatly changed, inasmuch as now the embryo occupies nearly one half the cavity within the amnion. The embryo, at this period, according to Wagner, is 2½ inches long, and weighs an ounce. The muscles and the nerves now begin to be developed, and the head to be separated from the trunk by a neck.

At the fourth month the uterus with its contents has enlarged to at least double the size that it possessed at the commencement of the third month, and the embryo occupies about ⅔rds of the amniotic cavity. The embryo is as yet but little doubled upon itself, and possesses ample space in which to change the position of its limbs. According to Wagner, the embryo is

4 inches long and weighs 5 ounces. The liquor amnii is about 2½ ounces, or half the bulk of the embryo.[101]

At the 5th month *the relative proportions* between the fœtus and the cavity (and therefore between it and the liquor amnii) is *but little changed from that found to exist at the 4th month, although the embryo and the cavity have been both much increased in size.* The embryo now, is 12 inches long, or 3 times the length it possessed last month.

At the 6th month the fœtus begins to be more bent upon itself, and to have its movements more directly interfered with (see Diag. 76). It has now become much

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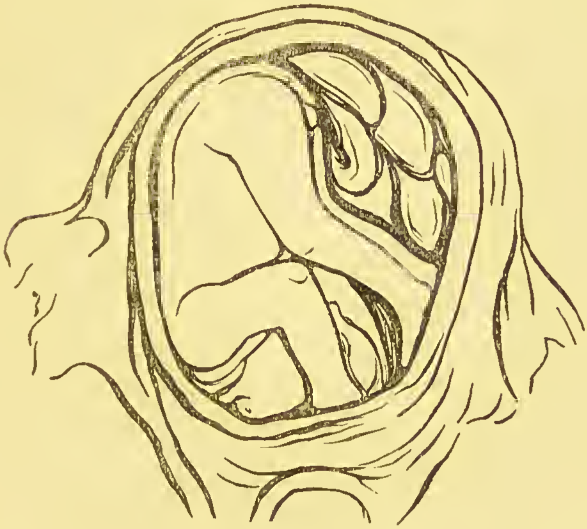

(Copied from Hunter.) E. J. C.

76. Outline copy of Plate xxii. of the Uterus and its contents in the Sixth Month.

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[101] During this and the preceding month, although the embryo possesses ample room, it is, nevertheless, according to Wagner, *always club-footed,* as described in the last Lecture, and represented in Diagram 69.

enlarged, and although the cavity is enlarged also, the relative proportions between the two are visibly changed, and the fœtus occupies at least ¾ths of the entire cavity. The development of the fœtus has now proceeded to that extent that instances are upon record of children having been born and lived at 6½ months of gestation, *i. e.*, at 28 weeks, or the beginning of the 7th lunar month.

At the 7th month, the drawing is evidently intended to show the fœtus through the membranes, and it is, therefore, not very intelligible for our purpose. We can, however, discern that the general position and proportions of the fœtus is gradually passing from that of the last month to that found depicted in the next drawing. It is now 16 inches long, and weighs 2 pounds.

At the 8th month, the fœtus is much more bent upon itself, as the knees, the arms, and the head begin to approach each other. The proportion of the general cavity occupied by the liquor amnii can hardly be more than one-fifth, as it is but little more than the general interspaces between the limbs and body of the fœtus, as the walls of the uterus are in apposition with its surfaces in several parts.

At the 9th month, the position of the fœtus represented in the drawing, demonstrates (see Diagram 77) that flexion of its body and limbs can go no further ;—the head, the arms, and the knees are in contact ; the leg and foot upon the opposite leg ; the head bowed down ; the walls of the uterus in contact with the surface of each of the various parts of its body, which form the external boundary of the globular mass which it assumes ; and the liquor amnii is now, even more so than in the last month, confined to the mere insterspaces and irregularities of surface existing between the various parts of the fœtus and the uterus. But here allow me to draw your attention to the fact, that if the liquor amnii

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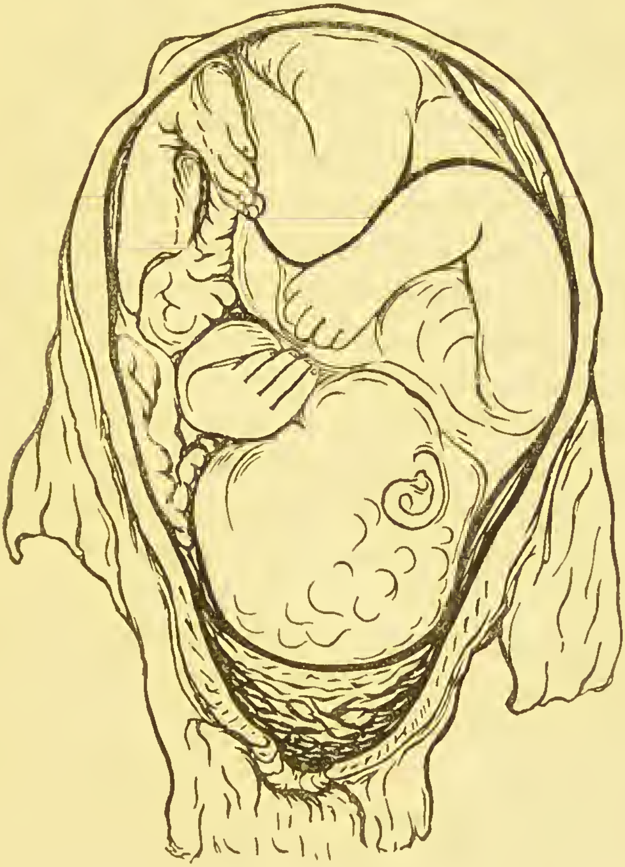

(Copied from Hunter. E. J. C.

77. Outline copy of Plate xii. of the Uterus and its contents in the Ninth Month. In this case the placenta is situated just over the os uteri, mentioned in page 104.

did not exist in a sufficient quantity to constitute a positive layer, no matter how thin, between the walls of the uterus and the fœtus, to equalise the pressure which at this time is exerted upon it, the child could never be born alive, as the pressure of any of the parts of its body against the placenta would arrest effectually the circulation of the blood through its vessels.

There is yet another mode in which a tolerably accurate opinion can be formed as to the ordinary relative proportions between the child and the size of the containing cavity, or, in other words, between it and the liquor amnii;—*viz.*, by comparing the weight of the child with that of the acknowledged ordinary quantity of liquor amnii; for example, the average weight of a male child is about nine pounds, and of a female, about seven pounds, and the average quantity of liquor amnii, according to Burns,[102] is about two pints, say two pounds; therefore, even by this mode of computation, there must exist at the full period of gestation, under ordinary circumstances, nearly *one-fourth part of the space of the containing cavity* in which the necessary movements of the fœtus can be performed.

The Cases just cited plainly demonstrate to us the ordinary relative proportions between the fœtus and the liquor amnii, and therefore of the size of the containing cavity of the uterus at the various specified periods; but these proportions doubtless vary in a slight degree in individual cases, while in some few and special instances occasionally observed, the variation is very great indeed, arising from an accidental abnormal superabundance, or deficiency of the liquor amnii, in comparison with the quantity ordinarily secreted, examples of both of which I have no doubt you have either seen recorded, or met with in your own practice.

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[102] "The quantity of water, upon an average, which is contained within the amnion, at a full time, is about two English pints; but sometimes it is much more, and at other times scarcely six ounces. In the early periods, the quantity is larger in proportion to the size of the uterus than afterwards."—"*The Principles of Midwifery*" (p. 134) *by John Burns.* 1801.

The amount of variation in the relative proportions between the fœtus and the liquor amnii at the full period of utero-gestation is far greater, in my opinion, than many persons would expect, as instances are upon record, in which the liquor amnii is stated to have been so *abundant* that even two gallons[103] have been known to have been discharged at the birth of the fœtus;[104] while, on the other hand, it is sometimes so *deficient*, that only about *a quarter of a pint* is expelled, *i. e.*, not more than about *one-eighth part* of its ordinary quantity; consequently, in *this latter case*, the movements of the fœtus cannot fail to have been interfered with, or constrained for a much greater period of time, and to a far greater degree, than could possibly occur when the liquor amnii existed in its ordinary proportions; and, *in the former instance, viz.*, when the liquor amnii was superabundant, the fœtus must have been entirely removed from any constraining force or pressure.

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[103] "No less than eight to ten quarts escaped."—*Lancet*, March 30, 1850, p. 385. I know of one case in which a like quantity existed. I shall adduce the particulars of this case at a subsequent part of this Lecture, see page 159.

[104] When this Lecture was given in 1852, I was unacquainted with any instance of a larger quantity. Since that time my friend Dr. T. Pollock has informed me of a case in his own practice, in which from three to four gallons were expelled; and at page 163, I have given the details of a case in which Dr. Hassall, of Richmond, reports that *nine* gallons *were collected and measured.*

From the account I have just given to you, and from the drawings I have introduced to your notice, you will perceive, that owing to the presence of the liquor amnii, it is *impossible for the uterus*, *in its passive condition*, to exercise any amount of constraining force upon an individual part of the fœtus, until quite the latter period of utero-gestation, say for the last six or eight weeks, at which time the fœtus is fully developed and viable, except it be in those few and rare cases, in which the liquor amnii is so deficient in quantity, that the uterine walls cannot fail to have been in contact with portions of the fœtus for a very much more extended period.

Up to the present moment, we have been considering the uterus as a firm and *unyielding* case of a roundish form, in which the fœtus is packed, an idea which we must, however, now discard, inasmuch as it is not only contrary to fact, but also because the clear comprehension of the constantly existing opposite state, *viz.*, that the uterus is a yielding covering, enables us to prove, that it is yet still more difficult to give rise to prolonged constrained position in a hand or a foot than it appears to be at first sight, or from examining a diagram; and I am strongly inclined to the opinion, that it is this error of regarding the uterus as a perfectly inelastic and unyielding organ, against the internal walls of which the fœtus is compressed as development proceeds, that has given rise to the prevalent opinion, that "position in utero" is capable of producing these deformities.

That the uterus, in its passive condition, is *not* an unyielding case, the experience of every medical man accustomed to the practice of Midwifery, or who has ever laid his hand upon the abdominal parietes of a female in the latter months of pregnancy, will enable him to testify, for he cannot have failed to recognise the fact, that the uterus *changes its shape* as often as the fœtus within *changes its position*, so that at one moment there will be a projection at some given part, say to the right of the umbilicus, while at the next moment the projection will be gone altogether, or its position will be changed to the opposite side, or be higher or lower on the same or opposite side, according to the direction of the movements of the fœtus; and, moreover, the projections themselves vary so much in size and shape, according to the part of the fœtus within pressing against the uterine walls, that you can form a pretty accurate judgment from the shape of the projection, whether it is caused by one of the extremities, or by the trunk, or by the head of the enclosed fœtus.[105]

As the walls of the uterus, previously to the commencement of actual labour, unquestionably permit of this alteration in form, from the pressure of individual parts of the enclosed fœtus, this fact alone presents an insurmountable difficulty in the way of our admitting the possibility of an injurious degree of constriction being exercised on the smaller members of the fœtus, for example, on a hand or on a foot, for the lengthened period of time that would be necessary to produce deformity, even if we admit it can produce it at all; inasmuch as, although a general state of constriction may have existed during the latter two months, yet these smaller parts, as the hand or the foot, even if for a moment, in some general movement of the fœtus, they became accidentally placed in a constrained position, the next movement of the fœtus would permit of its restoration, from the simple *yielding nature of the uterine walls*, and, for aught we know, the irritation occasioned by the constrained position[106] would be the exciting cause of the succeeding movements of the fœtus, by which it would be able to resume a more natural and easy position.

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[105] Previously to labour the uterus, *though full*, is *not distended*, and its walls are flaccid and *exert no force* on its contents. When labour *commences*, its hitherto passive condition is changed for one of activity, whereby the previously flaccid walls become tense, and the entire organ is converted in shape and feeling into a firm and solid ball, through the walls of which neither head, nor leg, nor arm can any longer be discriminated.

The conclusions to which we have therefore arrived in reference to the first part of the enquiry, distinctly limit the action of this supposed cause to the rare instances in which the liquor amnii is abnormally deficient. Let us, therefore, proceed to the consideration of the second part of the enquiry, *viz.*, admitting, for the sake of argument, the existence of such a state of constriction, that flexion and extension of a given part of the fœtus is prevented by pure want of space in the uterus, to determine whether that state of itself would exercise sufficient influence to produce deformity.

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[106] The movements which take place unconsciously during sleep, in order to induce a change of position of the body, and thereby to prevent the injurious effects of long-continued pressure on one part, &c., are induced entirely in this manner, *viz.*, by irritation in the part, and reflex nervous impulse giving rise to muscular action.

In the development of the human embryo, the limbs are found to begin, as it were, to bud out from the trunk about the third week (see Diagram 58). From this time the limbs gradually elongate and divide into the separate portions or joints, which parts become perfectly developed, internally and externally, by the tenth week, *at which period the relative proportion between the fœtus and the liquor amnii in all cases is such, that injurious compression cannot be exercised upon any of its members ;* but from this time until the completion of gestation, the impediment to their free movement becomes greater and greater, part after part becoming interfered with, beginning with the legs and thighs, the free extension of which, although at first but slightly interfered with, becomes subsequently quite impossible; while at the same time the head and neck, which from their first development *are always bent forward upon the chest* as the normal position, become compressed against the knees, &c., by the opposing surface of the uterine walls, so that, during the latter months of gestation, the fœtus is curled upon itself, with the arms across the chest as its natural position ; consequently, if the simple fact of impeded motion in a member *originally* accurately developed, and each of its parts endowed with its proper functions, could give rise to deformity, by enabling one set of muscles to obtain the ascendancy in power over their natural antagonists, or, to cause unequal development between them, we ought, as the rule, to have every child born with contraction of the neck, the thighs, and the legs, causing the head to be bent forward upon the chest,[107] the thighs to be drawn close up to the abdomen, and the legs to be partly flexed upon the thighs, thus constituting a degree of deformity, dreadful even to contemplate, but which, happily, is merely imaginary, as we know full well, that so far from such being the case, the new-born babe can kick its legs out, and the head instantly assumes its proper position, thus proving, that the impeded exercise of the function of certain muscles during the latter months of intra-uterine life, has *not* deprived them of their power, nor led to irregular development between them, and that they only require to be liberated from their constrained position to assume the exercise of their proper functions.

As such impeded movement is the natural condition of the parts to which I have alluded, during their intra-uterine life, *viz.*, the neck, the thighs and the legs, and as the effect of that impediment is not the production of deformity in either of those parts, I confess I am very loth to admit it capable of producing it in a hand or in a foot, the diminutive size of which renders it quite certain, that constrained position in either of them, even if it be possible at all, cannot be maintained for anything like the period of time which it is proved, in *all* cases, under all circumstances, exists for at least *six weeks with the thighs and the neck, without giving rise in the slightest degree to deformity.*

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[107] In the hen's egg the movements of the fœtal chick are absolutely interfered with by an unyielding case, and yet contraction is not the result; moreover, according to Wagner, the head is actually folded beneath the wing. See Note 110, p. 156.

A most interesting point of enquiry presents itself to us at this step in our investigation, *viz.*, supposing the foot or the hand retained absolutely and unchangeably in a constrained position by the surrounding parts,[108] during the greater part of the period of development, say for three or four months, would that of a certainty lead to deformity? To this proposition most persons would at first sight, perhaps, instantly accede their assent; nevertheless, there are some circumstances which may justly lead us to doubt the accuracy of such an opinion:—for example, the lungs, the diaphragm, and the intercostal muscles are all and each of them organs which never exercise their functions up to the period of birth, and yet at that moment they are one and all *called upon instantly to assume and exert it*; moreover, the life of the child depends upon the accuracy and promptitude with which they do so. May not the function of a voluntary muscle, or set of muscles of the limbs, remain in abeyance until the moment of birth, as well as the function of the intercostal muscles; or of the diaphragm; or of the lungs? Or again, the orbicular (voluntary) muscles of the eye-lids are, throughout intra-uterine life, up to the moment of birth, in a constant state of contraction,—indeed, they *are absolutely glued together* from the fourth to the eighth month;[109] nevertheless, their *antagonists have not lost power*, nor is the uniformity of action between them destroyed, for at the moment of birth they exercise their functions, and the eyelids open, and the mouth gives utterance to the cry which announces its birth. May not a muscle of the foot or of the hand also be retained, or remain in a passively contracted *position*, as in sleep (*not in an active state of contraction induced by irritation*), during a portion of the period of its development, and yet at birth possess, as well as its antagonist, its proper power? For my own part, I can detect no reason why a power exercised or possessed by one set of muscles should not be enjoyed by either of the others; and moreover, in my opinion, it is this principle, and this principle alone, which enables us to explain, in anything like a satisfactory manner, the fact that the thighs are not contracted against the abdomen; that the head, *which has been bent forward throughout its entire development*,[110] is not

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[108] In the bird's egg it is so.

[109] " ...... "and again in a greater perfection of the forms peculiar to the fœtal state. To the latter head belong the formation of the membrana pupillaris in the third month; the gluing together of the eye-lids first, and then their complete coalescence along their margins

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at the beginning of the fourth month" (p. 176); ...... "In the eighth month (thirty-two weeks), the membrana pupillaris disappears; and the epidermic sealing of the eye-lids begins to loosen."—*Elem. of Phys., by R. Wagner, M.D.*, p. 181.

In the kitten the eyes do not open before nine days after birth, sometimes fourteen, as I have just had an instance in my house.

[110] In birds, from the beginning of the third week, "the head is turned towards the breast, and mostly lies under the right wing" (p. 126). Also, "The labour of getting free from the shell generally lasts half a day; at length the upper part is raised, the chick pushes out its feet, *draws its head from under its wing*, and erecting itself quits the shell completely" (p. 129). "In embryos of the third and fourth week, the divisions of the vertebræ are very distinctly marked along the posterior aspect, and the caudal vertebræ (ossa coccygis) and forehead are brought close to one another in consequence of the curvature of the embryo."—*Elem. of Phys., by R. Wagner, M.D.*, p. 168.

The position of the embryo and fœtus, therefore, seems to be gradually "*unfolded*," instead of "*doubled up*."

drawn down upon the chest by the contraction of the muscles of the neck; or that the arms are not contracted across the chest.

Hitherto, our attention has been confined to cases in which the liquor amnii has existed in its ordinary relative proportion; but let us now enquire into those in which it is either abnormally deficient, or, on the other hand, in which it is greatly superabundant; for it is quite clear, that if "position in utero" can act as a cause of deformity under ordinary circumstances, *i. e.*, when the liquor amnii is about two pints in quantity, it ought to act, or, indeed, it could not fail to act, more and more energetically, in proportion as that quantity is diminished; or, on the contrary, *to cease to operate* altogether in those cases in which the quantity of the fluid greatly exceeded the ordinary amount, thereby removing the fœtus more and more from the possibility of compression.

The records of medicine furnish plenty of cases in which the quantity of the liquor amnii has been so small as to cause special attention to be paid to the fact, in some of which it has been even less than a quarter of a pint; but in none of these reports that I am acquainted with, is there any remark made bearing upon the form of the children, and it is, therefore, left fair to presume they were not in any way peculiar, because, had such peculiarity or deformity existed, it would most assuredly have been noticed and described, as well as the mere deficient quantity of the liquor amnii.

There is, however, another point worthy of consideration in regard to these cases, *viz.*, that if it was a fact that deficiency of the liquor amnii was always, or even frequently accompanied by deformity, the fact itself could not fail to have been noticed, and it would most assuredly have been brought forward by those authors who support the idea that deformity is the result of "position in utero." Such a connexion has not been traced and brought forward by these gentlemen, and we may, therefore, again presume it does not exist; consequently, in all these cases, the evidence expected from them fails entirely to prove the existence of any connexion bearing a relation of cause and effect, between the abnormal deficiency of the liquor amnii, and the presence of deformity; or rather, the evidence leads us a step in the reverse direction, and causes us still more to doubt the possibility of the occurrence of deformity as the simple result of mere "position in utero."

Let us, however, turn our attention to the opposite class of cases, *viz.*, those in which the liquor amnii is so abnormally superabundant in quantity, that the idea of the fœtus extending through its volume so as to be compressed against the opposing internal walls of the uterus so firmly as to arrest the movements of flexion or of extension of the muscles of a hand or of a foot, or to prevent the fœtus changing its general position, borders so much upon an absurdity, that it cannot be maintained for a moment; and let us ascertain whether in *these* cases that perfect immunity from deformity exists, which ought to exist if deformity was in any way the result of mere "position in utero," inasmuch as if such immunity does not exist, its absence constitutes of itself almost, if not entirely, conclusive evidence against the idea of deformity being the result in any case of mere "position in utero."

In a former part of this Lecture I stated to you that I should have occasion subsequently to introduce to your notice an instance of superabundant liquor amnii, which instance I refrained from laying before you at that time, because it bore so directly upon this part of our subject. The case is as follows, and it was considered of sufficient importance to form the subject of a communication to the Westminster Medical Society by — Greenhalgh, Esq., in the session 1844-5.

"Mrs. M——, at 42, a stout healthy-looking woman, in the 8th month of pregnancy, having ceased to menstruate on the 3rd of May last (1844), was seized with slight grinding pains of labour at 10 o'clock A.M., on Tuesday, December 3, 1844, which lasted up to 7 o'clock, P.M. While sitting and talking with her husband and two children, but using no exertion, the membranes ruptured, and, to use her own expression, 'went off like a gun,' much to the consternation of her husband, and astonishment of the children.

"I was instantly sent for, but being from home, did not arrive until 8 o'clock, when the nurse shewed me about 1½ gallons of liquor amnii, which had passed from her, of a sanious hue, possessing no fœtor.

"On asking her several questions I learned that although she had had 8 children, yet with none had she felt 'so strange' as during this pregnancy; for example she had no swellings of the breasts, which were even smaller than usual, *nor had she felt the motions of the fœtus as on previous occasions, and consequently doubted whether she was pregnant.*

"As she was flooding considerably, I desired her ..
....

"The hemorrhage still continuing, I determined instantly to extract the fœtus, which was accomplished in less than 5 minutes, the placenta speedily following. Up to the present time, December 7th, she has not had a bad symptom.

"The fœtus, a male, appears to be between 5 and 6 months of utero-gestation.

"The cuticle peeled off with ease from the surface of the body. The child is acephalous, little or no frontal development, but having a tumour protruding from the posterior fontanelle, containing cerebral matter covered by the membranes of the brain—*the left hand instead of being continuous in a straight line with the fore arm, is joined at right angles, the fingers looking towards the trunk; the foot of the same side is also directed somewhat inwards*—at the Umbilicus is a swelling composed of the abdominal integuments and peritoneum enclosing a great portion of the liver, stomach, and small intestines, a portion of the liver and bladder (without any covering) protruding through an opening to the left of the tumour. At half an inch from this swelling, and situated on the funis, is a cyst containing a serous fluid, and when examined under the microscope with ¼-inch lens, presented the appearance of numerous hairs, mucous, &c., as delineated; at 1¼-inch distance from the preceding is another cyst about the size of a hen's egg, containing a similar fluid, the funis appears to run through these cysts. There are several others of like size situated along the cord, and at its insertion into the placenta there is a tumour presenting the appearance of a pile—the funis throughout its whole extent is twisted in a very remarkable manner.

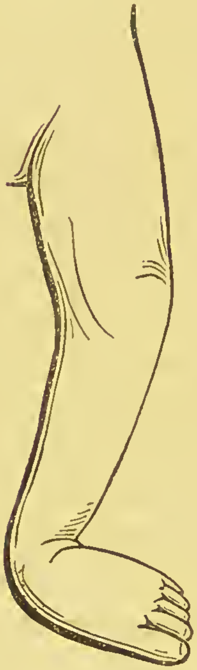
"The placenta is tolerably healthy, but having, for about ⅔rds of its extent on the fœtal surface and at the margin, a ring resembling a deposit of lymph beneath the membranes, which contain between them a large quantity of bloody-looking jelly.

"The thorax and pericardium contained within their cavities a considerable quantity of bloody serum. The heart is unusually large, the right and left ventricles being joined by a very slight septum—the lungs are collapsed and appear well formed."

The fœtus itself, of which the above is a description, was exhibited to the society, and was lent to me after the meeting by Mr. Greenhalgh, that I might the more accurately examine it, and take a cast of the limbs. The casts are now upon the table, and you will at once recognize the deformity of the hand and foot specified in the description. See Diagrams 78 and 79, p. 162.

The case just narrated is interesting to us at the present moment in three points of view, *viz.*, in the *first* place it is a distinct account given by a gentleman, who at that time, in conjunction with myself, filled the office of Honorary Secretaries to the Westminster Medical Society, of a case in which the portion of the liquor amnii collected and *exhibited to him* by the nurse, amounted in his judgment to about a gallon and a half, so that allowance being made for the quantity that had escaped uncollected at the moment of the rupture of the membranes and subsequently thereto, little less could have existed in this case than the amount formerly specified as occasionally existing, *viz.*, two gallons; in the *second* place it is worthy of remark that the effect of this large quantity of fluid was evidenced during gestation, for the lady doubted whether she was pregnant, as she had *not felt the motions of the fœtus* as on previous occasions, thus showing the fœtus did not extend through the bulk of the fluid so as to

No. 78.



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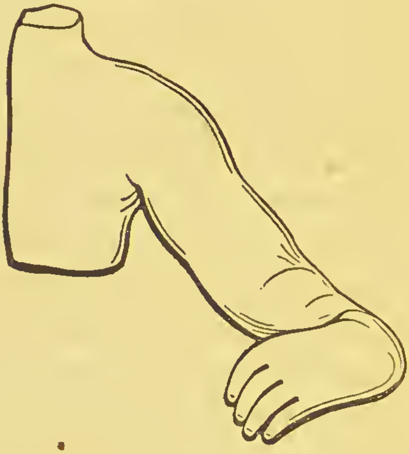


78. The left Leg and Foot of the Fœtus in Mr. Greenhalgh's case. The Foot is greatly abducted, thus constituting a well-marked and severe case of Talipes Valgus. The right Leg and Foot were quite normal.

79. The left Arm and Hand of the same Fœtus. The Fore-arm is only one-half of its normal length; and the Hand is contracted at the Wrist directly inwards. The right Arm and Hand were quite normal.

influence the walls of the uterus by its movements;—and in the *third* place, from the occurrence of contraction of the hand and foot, notwithstanding the immensely disproportionate quantity of the liquor amnii, and the consequent impossibility of the fœtus having been subjected to compression from the uterine walls;—and, from the fact that the deformity of the foot, is moreover, of the precise kind (Talipes Valgus) which is said by Mr. Tamplin to arise from "position in utero" and "position alone" (see p. 140). In this case it was not possible for the fœtus to have touched the uterine walls on two sides at the same time, so that it is evident that the Deformity must have arisen from some cause acting independently of the uterus.

A second and even a still more remarkable case of superabundant liquor amnii, has recently been communicated to me by my friend Dr. Robert Barnes, Physician to the Royal Maternity Charity. It occurred in the practice of Dr. Hassall, of Richmond, in September, 1855, by whom the facts were communicated to Dr. Barnes. The case is moreover most interesting, inasmuch as it is a well-authenticated instance of the coincidence of the occurrence of fright and the existence of deformity, or, in other words, of the *supposed* influence of vivid mental emotion in the mother causing deformity resembling the object which gave rise to the emotion. It is as follows, and I will give the account in Dr. Barnes's own words, *i.e.*, as reported to him:—

"The subject of the case is a Mrs. Moody, of Prince's Street, Richmond. In 1855 she was thirty years of age. She had enjoyed fair health, but was of a highly nervous temperament. She had borne several healthy well-formed children. There was this peculiarity about her pregnancies, *viz.*, that she had always an excessive quantity of liquor amnii.

"According to her account she quickened on the 12th April, 1855, which would fix the date of conception at about the 1st February. Things went on until about the fifth month without any unusual symptoms. The only circumstance that struck her was her extreme smallness, which was such as sometimes to make her doubt whether she were really pregnant.

"About the 14th August, the event occurred to which the malformation of the infant was ascribed. A woman brought a cat into the room where Mrs. M. was sitting, which presented a horrible spectable from the brutality it had endured at the hands of some boys in the street. The cat had been struck on the right side of the head with a stone, so as to force the eye down upon the cheek; the blow had also split the skull in the mesian line, making a V-shaped opening down to the brain. This revolting sight so shocked Mrs. M. that she felt sick and faint, and went up-stairs, expecting to miscarry. These symptoms went off on the following day. But she now began to increase rapidly in size, so that at the end of six months pregnancy, she consulted Dr. Hassall, of Richmond, to whom I am indebted for all the facts of this case, on account of her enormous size and great discomfort. It was upon this occasion that she described minutely to Dr. H. the whole history of what I may call, for brevity's sake, the cat-catastrophe. She ascribed to the shock she then experienced the origin of her illness, and expressed her belief that her child would be found, when born, to be malformed. The distension of the abdomen was extraordinary; by it the breasts were lifted up to the shoulders; the abdomen rested on the knees; the integuments were much thinned; fluctuation was felt in every direction. The os uteri was dilated so as to admit the end of the finger. The membranes were not felt tense or protruding. The impression at first drawn from her appearance and his examination was, that Mrs. M. was labouring under ascites, or ovarian dropsy, and tapping was contemplated, if on emptying the uterus by a catheter it should be found that the distension was not relieved. Neither of these operations, however, was performed. On the 14th September, which was estimated to be about seven-and-a-half months from the beginning of pregnancy, the membranes ruptured spontaneously; nine gallons of liquor amnii were actually collected in vessels, and measured; she was afraid, and not without reason, of being drowned in her bed, and rolled off to the floor. The bed and the floor were deluged. Twelve hours later labour set in. During the pains she repeated her fears that the child would be disfigured, and particularly described the injury the cat had received.

"When the child was born, it presented the following appearances:—there was an indentation on the right side of the head corresponding to the seat of the blow received by the cat; then there was the mesial fissure down to the brain; and there was the right eye depressed from its natural position, and hanging down upon the cheek. The hands and feet also exhibited a remarkable paw-like appearance. The thumbs were very short; the nails were claw-hooked; the skin of the hands extended down, binding the phalanges of the fingers together, covering part even of the nails, so as to leave only the tips exposed. The nails, except in their form, were like those of a fœtus at the period. On feeling the fingers, all seemed properly formed, but as though a mitten had been drawn over them.

"The same description applies to the feet, but the peculiarities were, if possible, more marked.

"The general appearance of the head and face, and especially of the hands and feet, are reproduced and preserved in a photograph taken at the time." [The Diagram in the Appendix is an exact tracing of the photograph.]

This case is most interesting, as a reliable record of the *enormous quantity of liquor amnii* that is sometimes secreted; and as it demonstrates so fully with the preceding case that superabundance of the liquor amnii and deformity frequently coexist;—indeed I think it will be found, that an abnormal quantity of the liquor amnii rarely occurs *without* deformity, *monstrosity*, or the *death* of the fœtus.

The foregoing cases, therefore, when taken in connexion with those in which the liquor amnii was deficient, prove, that as regards its influence in causing or preventing deformity from "position in utero," the *quantity* of the liquor amnii, whether small or large, affords us no evidence whatever in support of such an opinion;—but on the contrary, as a less quantity of the liquor amnii than usual is generally found coexisting with a normal child, the direct inference is, that constrained position in utero, arising from the *absence* of the *liquor amnii*, exerts no influence whatever in preventing the normal development of the fœtus: for which reason, added to the others I have previously brought before you, I feel averse myself to admit it, *viz.*, position in utero, to be capable of producing deformity, and I only place it among the causes set down in my table, in deference to the opinions of those gentlemen who have preceded me in writing or lecturing upon this subject.

The last case, however, is also deserving of our especial consideration in regard to the opinion of the mother that the monstrosity of the fœtus was occasioned by the horror experienced on beholding the mutilated cat; and also because of the undoubted fact that she maintained and often expressed that opinion to Dr. Hassall from the first receipt of the fright. This subject, however, has been fully considered in Lecture III., moreover, it is irrelevant to the cause of deformity now under consideration, for which reasons I must not resume its consideration in this Lecture. It is, nevertheless, far too pertinent to the subject of Lecture III., and apparently too contradictory to the opinion therein maintained, to be passed by without comment, for which reason I shall resume its consideration in the Appendix, and also give a traced copy of the photograph.

The next and last cause of congenital deformity that I have to bring under your notice, consists in an Alteration in the Structure, or of an interference simply with the functions, of one or more parts of the fœtus as the result of *disease*.

That the fœtus in utero is liable to disease from the moment its tissues are sufficiently developed to admit of such an action occurring in them, is a matter admitting of no dispute, as cases are of daily occurrence, and as instances can be quoted from the works of the most accredited writers of the day, proving that disease of almost every tissue of the body, from the simple membrane composing the embryo of a month old, to the osseous tissue of the full-grown fœtus.

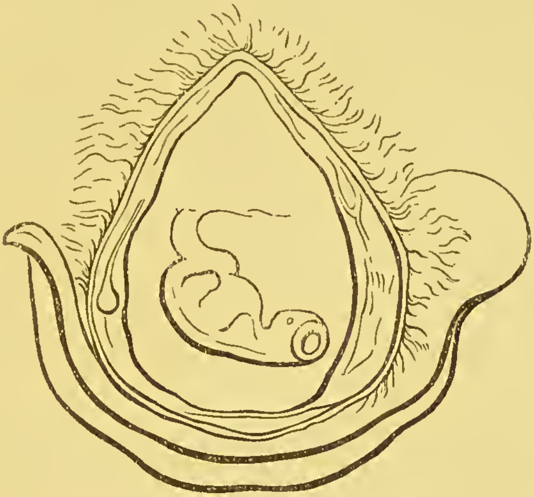
For the purpose of our present enquiry, it will be sufficient simply to enumerate the various forms of disease observed and recorded, without in any way entering into the detail of individual cases.

The first author I shall cite in support of this fact is J. S. Streeter, who in a small but valuable work, entitled "Practical Observations on Abortion," published in 1840, adduces two instances of monstrosity *in the embryo*, as early as the sixth week of development, that had occurred in his own practice. In each case he had preserved the embryo, and given lithographed drawings of them in his work; the cases are therefore of great practical value, as affording distinct and indisputable evidence that both deformity and monstrosity *originate* at these *early* periods of existence, and not at the fifth or sixth month as supposed Of one of the embryos (Diagram 80) Mr. Streeter remarks:—"As far as I am aware, it is nearly, if not quite unique in this country, and belongs to that class of pathological ova which throws light on the origin of anencephalous monstrosities." To the correctness of this opinion I fully agree.

The embryo to which the foregoing remarks apertains is represented in Diagram 80, copied in outline from Mr. Streeter's work. Mr. Streeter's own description is as follows, p. 36:—

"The ovarian ovum came away with its membranes unbroken, and covered by a perfectly healthy reflexa. When this was dissected back, and an opening made in the proper ovarian envelopes (the chorion and amnion) a fœtus of about six weeks' size was seen with a cephalic perforation. This opening, as the drawing shows, is circular in shape, and its marginal edges smooth and well defined. Through it the rudimentary portions of the brain were seen without any protective coverings. It would seem that one of the primary cerebral vesicles had enlarged and ruptured itself, and also the cranial integument. The objects are so minute and the cerebral structures so delicate, and so liable to have undergone alteration from maceration in the liquor amnii, that I shall not attempt to describe any of the cerebral appearances."

No. 80.



(Copied from Streeter.) E. J. C.

80. A monstrous Embryo of the Sixth Week. Mr. Streeter's description is as follows :—"An Ovum which was passed in Abortion by a patient twenty-one hours after returning from a party where she had danced the whole evening." ...... "The Embryo and Umbilical Cord are seen in their natural condition about the Fifth or Sixth Week." ...... "The vesicula umbilicalis and its pedicle are also in a very perfect state."

The second case Mr. Streeter adduces he describes as "an example of imperfect development of the *caudal* extremity of the fœtus."........."I am disposed to assign it an age of from six to eight weeks," p. 35. The lithographer has depicted the embryo so indistinctly that I do not attempt to copy it. In these two embryos, therefore, we have the absolute and visible proof of the origin of deformity and monstrosity before the sixth week of existence.

In the "Edinburgh Medical and Surgical Journal," (No. 60, page 390,) Professor Simpson, in an article entitled "Contributions to Intra-uterine Pathology," states:—"In the recent progress of pathology, it has been amply proved that the fœtus in utero is liable to a considerable variety of morbid states; of its diseases, some, we have reason to believe, are altogether of a functional nature." And again, in another article "On the Diseases of the Placenta," (No. 50, page 278,) he states:—"We now know that the fœtus in utero is liable to various febrile, contagious, malarious, and inflammatory infections—to plague, small pox, and perhaps measles and scarlatina; to ague, and a number of acute internal inflammations." And in the course of the articles here cited, the author brings forward instances of the following diseases, and in most cases gives an account of the morbid lesions found upon examining the body after death, *viz.*—1. Peritonitis. —2. Enlarged mesenteric glands. Post mortem.—3. Ditto, ditto.—4. Indurated and enlarged lymphatic glands surrounding hepatic duct. Post mortem.—5. Enlarged abdomen retarding delivery. Legs drawn up firmly until the time of death. Lived 48 hours. Post mortem. Stomach, upper intestines, and colon much distended with air.[111]—6. Hepatitis.—7. Enteritis.

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[111] In a case (Harry Saunders, aged 1¾) under my own care; the legs could not be drawn down to put on a napkin. He was born so. I have seen several others. Was this from flatulency?

Born alive. Lived 1½ hours. Post mortem.—8. Acute Hepatitis.—9. Peritonitis.—*Recovery.*

The author of the article "Fœtus," in the "Encyclopædia of Anatomy and Physiology," to which article I would refer you for much and valuable information upon this subject, states:—"We have reason to believe the child before birth is not only liable to certain affections, *which may be considered peculiarly its own*, but is also subject to almost all those which affect the adult." Again:—"The germ, even before its vivification in the ovary, may have a morbid taint communicated to it from the system of the female in whom it resides, or from that of the man with whom she cohabits, so that the tendency to disease or malformation sometimes precedes the first impulse that leads to the establishment of life."

Among the cases quoted by Mr. Montgomery (the author of the article in question), from the works of the greatest authority, I have selected the following list out of a very many more, as these appertain more directly to my present purpose:—1, Convulsions; 2, Peritonitis; 3, Gastritis; 4, Hepatitis; 5, Pneumonia; 6, Suppurating tubercles in lungs;[112] 7, Pleurisy; 8, Abscesses in neck; 9, Dropsical effusion; 10, Induration of cellular tissue; 11, Cutaneous affections; 12, Small pox; 13, Pemphigus; 14, Pericarditis; 15, Ulceration of the intestines; 16, Premature teeth;[113] 17, Intestinal

[112] Andral (vol. ii. p. 539, translation) mentions the case of a newborn infant, whose lung contained several large abscesses. They had no resemblance whatever to tubercular excavation."—*Cyclop. of Pract. Med.*, vol. i. p. 16.

[113] August 10, 1850. I have this day had a patient brought to me at the Metropolitan Free Hospital, who was born with the two middle

worms;[114] 18, Jaundice; 19, Rickets;[115] 20, Fungus hæmatodes; to which list may be added, 21, Fracture;[116] 22, Gangrene;[117] and lastly, 23, Paralysis, cases of which

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incisors of the lower jaw above the gum. ...... I have also had a second case (Solomon Abrahams, Gravel Lane, Houndsditch) born with two teeth.—E. J. C.

[114] The Tape Worm (Tænia Solium) is known to exist in the fœtus. See *Cyclop. of Practical Medicine*, vol. iv. p. 511.

[115] Cases in Museum of Royal College of Surgeons; also see p. 195 for an account of a Rachitic Fœtus.

[116] Fracture of the tibia of a fœtus in utero communicated by M. Carus. *Lancet*, 1827, April 27, p. 14:—"A servant, twenty-five years of age, and of robust constitution, having fallen on her abdomen in the sixth month of pregnancy, felt the movements of the child very strong, which however soon ceased. The delivery took place in the usual way. The child was thin and weak, and manifested but few signs of life. A transverse wound was found on the right leg nine lines long, passing from one malleolus to the other, penetrating through the skin. The tibia was fractured, and in such a manner that the malleolus was separated from the rest of the bone. The tibia was thrown outwards, presented a bad appearance, and had lost its periosteum. The edges of the wound were pale and flaccid. The fracture could not be reduced, because the edges of the wound were sphacelous, and the necrosis was of such great extent. The child died on the thirteenth day after birth. This is another proof," says M. Carus, "during the fœtal state diseases may be endured, which after birth prove fatal."—*Gemeinsame Deutsche Zeitschrift fur Geburtskinde*, tom. ii. cah. 1, 1827.

[117] "The following case is detailed in 'Gräfe's and Walther's Journal' (vol. ix. p. 1) by Dr. Wedemeyer of Hanover:—'A woman was brought to bed a month before her time with twins. One of the children was quite putrid, and dead born; the other, however, was alive, but there was gangrene of one of its lower extremities, extending from the foot to the knee. The ancle-joint was exposed, and both tibia and fibula were projecting through. The child died on the following day. On examination, the femoral artery, half way down the thigh, was found closed by a caseous kind of lymph. During

I have myself seen; and others are adduced by Dr. Todd, in the "Cyclopædia of Practical Medicine."[118]

In the catalogue of diseases which I have just read to you, and which are proved beyond a doubt to have occured in the fœtus in utero, you will find instances of almost every one of the diseases, whether purely functional, or dependent on organic change, which I shall have occasion subsequently to bring before you as the admitted causes of many of the deformities which occur after birth; consequently we can have no hesitation in admitting disease to be one of the causes giving rise to congenital deformity.

I cannot, however, pass entirely from this subject without especially drawing your attention to the fact, that, 1, Premature Dentition; 2, Intestinal Worms; 3, Irritation and Inflammation of the Intestines; and 4, Convulsions, are to be found in the list I have just read to you, of the diseases and affections which have been found to exist previous to birth. The *three first* of these sources of

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pregnancy, the mother had experienced nothing, to which the death of the one, and the mortification of the other child, could be ascribed.' "—*Lancet*, 1827, p. 454.

[118] The cases adduced by Dr. Todd are from the "Memoirs of Cazauvieilh" (see *Archives, Gén. de Méd.* for May and July, 1827) upon congenital paralysis:—"In the majority of the cases detailed in these memoirs, the paralysis was in the form of hemiplegia, the limbs were greatly wasted, stunted in growth, and with many in a state of permanent flexion. The upper extremities were generally more altered than the lower; in many cases they were bent and contracted, the elbow, wrist, and fingers being flexed. Among the muscles of the lower limbs, these of the calf of the leg chiefly presented the phenomenon of contraction, and thereby kept the foot permanently extended" (talipes equinus).—*Cyclop. of Practical Medicine*, vol. iii. p. 254.

irritation are admitted by all writers upon the diseases of children to be among the chief primary or exciting causes of the last, *viz.*, convulsions, during infantile life; and all of which, we shall hereafter see, are among the chief of the causes of several varieties of deformity which occur during childhood;—or, without introducing to your notice the opinion of the most experienced experimental physiologist of the day upon the nervous system, *viz.*, Dr. Marshall Hall, who expresses himself thus, in a paper read before the Medical Society of London in 1847, "On the Convulsive Affections of Infants and Children," published in the *Lancet*, June 12, 1847:—

"It is a singular fact that the age of convulsive diseases is especially that of dentition, and of what I may term dubious diet. Dentition, as I understand the term, begins at birth, *or even before;* it is then that the tissues of the alveolar processes and cavities become the seat of augmented vascular action and nervous excitement, which do not cease until dentition is completed. *I think it probable that many convulsive affections and their dire effects have their origin in utero;* certainly many of the latter are congenital."

The fœtus in utero is therefore proved to be occasionally affected by spasmodic or convulsive disease, as well as by paralysis; and these affections may arise either at an early, or a late period of uterine life, and give rise to deformity of greater or less severity accordingly. Whatever the origin of this spasm may have been, the spasm itself may be either tonic and transitory, (as in nocturnal spasm of the calf, from which, who has not suffered?) or of a more protracted, or even of a permanent character; and it may be of greater or less severity; but when it is once excited, its modes of terminating are as follows:—

1stly, In perfect subsidence, or restoration to healthy action.

2ndly, In partial subsidence, in which case the muscles are from time to time acted upon independently of the will, *i. e.*, are only partially under the control of the will.

3rdly, In paralysis—and, therefore, if these variations as to the early or late period of its accession, and the brief or prolonged continuance of the spasm, be taken in connexion with the modes in which spasm terminates, they will afford us an explanation of the great difference that exists between several congenital deformities, which present externally the same character, although the muscles are in very opposite conditions.

If spasm be induced early in fœtal life, and be so transitory as to pass off again in a few minutes or even days, it may possibly do so, as in after life, without inflicting any injury on the muscle that has been subjected to its action; that is to say, it may, in accordance with the first mode of termination that I have described, subside perfectly, and leave the muscle in a state of health, examples of which in childhood I shall bring before you in a succeeding lecture;—but, if instead of passing off in this manner, the spasm continues for a more or less protracted period, during which the fœtus has absolutely advanced in development (no matter how small the portion of increase, and a *few* days is sufficient for a *considerable* increase,) in that case the muscles so affected cannot fail to be injured proportionately to the severity and *continuance of the spasm.*

The manner in which the muscles become injured by spasm in intra-uterine life, appears to me to be the following: *viz.*, that during all the time the spasm exists, the muscle, or set of muscles, so affected, are forcibly *contracted* to their utmost, and maintain the shortest possible line between their origin and insertion, as a necessary consequence of which their antagonists are first drawn into, and afterwards passively remain, in a fully *extended* condition, from the retention of their points of attachment at the furthest possible distance from each other. Throughout all the time, the muscles are thus affected, the development of the fœtus progresses with great rapidity; and although the actual increase in bulk and length of the entire fœtus may appear minute, that amount of increase, however small, is nevertheless immeasurably greater *in proportion to the entire bulk of the fœtus*, than can occur at *any future like* period; consequently, if this spasmodic condition of a muscle, or set of muscles, be maintained, but for the brief period that would be requisite in intra-uterine life for the development of ever so short a portion of the length of an arm or of a leg; as that *short* portion is the representative of a much larger portion in after life, each of the contracted, and of the extended muscles of that member, would be thus *permanently fixed* in a relatively *disproportionate* length, by the increments of newly formed muscular fibre having been added, in the one case, to a muscle in the condition of firm spasmodic contraction, with its point of attachment approximated to the utmost; and in the other, to a muscle in a state of *full, normal, and passive extension.*

It is therefore evident, from the foregoing statement, that *after the subsidence of the spasm*, the muscle that had received its increment of new tissue, with its points of attachment drawn together to their utmost limit, could never after acquire by development the portion thus arrested in its progress of development, although it would possess the property of contraction and of extension belonging to the muscular fibre of its length within the normal given limits;—and the muscle that had received its additional length in a fully extended state, could never after lose the portion of *extra length* that it had acquired by its development in a fully *extended* state, and it could not, therefore, possess the power of drawing its points of attachment to their nearest approximation, even if its antagonists were not contracted, or were removed altogether, as its fibres would be too long for such a purpose. Both of the muscles, or sets of muscles, are therefore injured. In the first case, the fibres of the muscles are too short to permit of the separation of the points of attachment to the normal distance, and the muscle itself is said to be in a condition of "congenital structural shortening."[119] In the *latter* instance, the muscular fibres are too long to permit of their contracting sufficiently to draw the points of attachment of the muscles to their normal position in full flexion of the part, and it is therefore as much congenitally *elongated* as its antagonist is congenitally *shortened.* *In both instances*, the muscles are *much less in size and in power* than those of the opposite limb, or than they *would have been* had they been free to move during development to the full and normal extent.[120]

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[119] I wish particularly to draw attention to the difference between "congenital structural shortening" and that which results from disease, &c., after birth. In the former case it is simply *retarded growth* in one muscle, *while additional length is added to its antagonists;* in the latter case it is a *diminution of the length* of the contracted muscle by the *removal of a portion of the previously developed muscle,* the antagonist muscle remaining of its original length.

That such is the state of the muscles in many cases of club-foot, I shall hereafter demonstrate to you; at the present moment, the following case of W. J. Mattocks, aged ten weeks, will illustrate it:—The left foot is shorter than the right, adducted and extended about mid-way. The plantar fascia is not contracted. The foot and leg up to the knee are a little smaller than the right. The foot can be brought from its *ad*ducted position (varus) until it is nearly straight with the leg; but it cannot be *ab*ducted in the least; and it can be flexed nearly to a right angle with the tibia, but firmly resists the attempt to move it beyond that point. The child at intervals moves the foot voluntarily in these directions, but it immediately afterwards returns to the position of T. Eq. Varus, as if that position *allowed both sets of muscles to be in repose, i.e.*, neither contracted nor extended. These voluntary movements demonstrate that the muscles on both sides of the leg are in a condition to contract or expand under volition.

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[120] It may doubtless be inferred that muscular fibre is not developed in a state of positive contraction or of positive extension, but in a condition midway between each state; *i.e.*, in a state that admits of its exercising both properties within certain definite limits proportionate to its length, which limit is believed to be about ½ of the length of the fibre; therefore, the newly acquired muscular fibre, *in a muscle retained in a state of contraction*, must be shorter than it would be, if during its development its points of attachment were separated further from each other; and the newly acquired fibre in the *expanded muscle* must be, from the like reason, longer than it would be if it were developed under a normal condition of the parts.

Whenever such a disproportion has been once produced, no other circumstance than the establishment of the reverse condition to those which produced it can ever restore the muscle to an equality of power, *viz.*, by allowing development to go on in the congenitally shortened muscle, while it is in an *extended* or *relaxed* state, and its antagonist is contracted. The nearest approach to which condition of circumstances is to be found in the state of the muscles after an operation for congenital club-foot, in which case the fibres of the shortened muscle are relaxed from the division of its tendon, and those of the elongated muscle maintained in a position admitting of their contraction.

If the cause of the spasm be of the more permanent character, and prolonged and excessive action be the result, there can be no doubt, that at this early stage of development, paralysis would ensue,[121] whereupon not only would the same congenital irregular development just mentioned, as regards length, be the certain consequence; but also, in addition thereto, a structural *disorganization* or *degeneration in the paralysed*

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[121] I feel fully assured that this is a frequent cause of paralysis in children. The cases of this kind are supposed to arise from "a fit during sleep."

muscle, and, in all probability, an irregular growth of the bones of the part, as seen in Talipes Calcaneus.

In some cases, as I have previously informed you, the spasm does not occur until late in uterine life, or only just before, or at the moment of birth (if the moment after,[122] how is it to be distinguished?); and in this case the effect of the spasm in the production of deformity will be the same as at an earlier period; but now, as growth does not proceed in that relatively rapid manner as it did in the early months of life, structural shortening could not ensue.

The deformities which result from "disease during uterine life," are of two kinds, *viz.* :—

1stly. Of those which essentially consist of abnormal muscular action; and,

2ndly. Of those in which the osseous system is the part chiefly affected.

I have previously brought under your notice the various kinds of deformity which arise from irregular muscular action, and you will doubtless expect to find that the greater part, if not the whole, are congenital, as it cannot matter, so far as the production of deformity is concerned, whether the irregular muscular action occurs before or after birth. In this expectation you will not be disappointed, for the list of congenital deformities observed and recorded by one author or another already contains almost every variety of contraction, *viz.*, of the toes, of the feet, of the legs, of the thighs, of the fingers, of the hands, of the arms, of the head sideways, or backwards, or forwards; of paralysis of one or more muscles; of luxation of the hip; of curvatures of the bones; of distortion of the spine, &c.

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[122] In a case under my own care, violent fits occurred the day after birth in an infant born with Talipes Equinus. In this case it is possible the fit was the result of causes *that had been acting previously* to birth and had originated the deformity. In a second case there was congenital *paralysis* of the arm, and fits. In this latter case instruments had to be used to complete labour, and it is therefore probable the paralysis was induced thereby at the moment of birth.

The congenital deformities which arise from disease affecting the osseous system, are caused either by rickets or scrofula. These causes, however, will be fully considered in the next Lecture.

SYNOPSIS OF LECTURE V.

CONSIDERATION of the Nature of the Exciting Causes of ACQUIRED DEFORMITIES.—1stly, Causes acting directly on the Osseous Framework, and inducing an Alteration in the Structure of the Bone itself *a* Rachitis and *b* Scrofula—Rachitis and Scrofula considered by many the same Disease—Composition of Bone—Abnormal character of tho contents of the Cancelli and Medullary Cavities in Rachitis and Scrofula—Difference in the character of the Fluid in each Disease—General character of Rickets—Essentially a Disease of imperfect Nutrition—Sometimes dormant—Period of Life at which it usually first manifests itself—Experience of Guérin—Rachitic Deformities as frequent in one sex as the other—Part of the Skeleton most frequently affected by it—Causes of the greater frequency of Curvature in one part than another—Guérin's experience on the order of frequency of Rachitic Deformity in different parts of the Skeleton—Deficiency in Length of Rachitic Bones—After the cessation of Rachitis, the Bones become abnormally solid—Rickets of adult Life—Scrofula—Character of the Medulla Ossium—Distinctive differences between it and Rickets.

LECTURE V.

ACQUIRED DEFORMITIES.

At my last Lecture I concluded the consideration of the causes of congenital deformities; I have, therefore, to-day to commence an enquiry into the nature of those which are capable of giving rise to such deviations of form subsequently to birth.

In my first Lecture I pointed out to you that whatever the nature of the inducing cause of deformity might be, no matter whether it acted before or after birth, it must act either directly or indirectly upon the skeleton. I shall, therefore, in conformity with this rule, commence the present part of our enquiry with the consideration of those causes which act directly upon the osseous framework, and subsequently pass on to those which act on the other tissues.

In the definition of deformity which I gave you in my first Lecture, it is distinctly stated that the deviations to which the skeleton is liable consist of an alteration "in the number, in the structure, or in the form" of the bones composing it. We have, therefore, to examine each of these.

Alteration in the number of the bones, or the first of the deviations alluded to, can, of course, only occur as a congenital deformity, or, as the result of mutilation by accident or surgical operation; the first of these causes of the deviation has been already considered; and the latter requires no further notice than its simple enumeration.

Alteration in the structure or in the form of one or more of the bones composing the skeleton, which constitutes the second and third deviations to be noticed, may occur from the following causes:—*viz.*, 1stly, from disease of the bone itself; or, 2ndly, from mechanical injury; we have, therefore, to institute an enquiry into each of these causes.

The diseases that are known to be possessed of the power to effect an alteration in the structure and in the form of the bone, are Rachitis and Scrofula, both of which diseases I brought before you at the termination of my last Lecture as unquestioned causes of congenital deformities.

Rachitis and Scrofula are considered by many as the same disease, the first being regarded as only a symptom of the general affection known as scrofula; for example, Sir Charles Bell,[123] in a lecture given at the Royal College of Surgeons in 1833, says, "Rickets is a scrofulous disease—a disease of infancy; it is one effect of a disease which exists not only in the human body, but in that of brutes also." To this opinion, although advanced by so high an authority, I cannot agree, inasmuch as each disease presents characters which are peculiarly its own, as I shall have occasion presently to demonstrate to you.

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[123] "Lancet," 1833-4, vol. i. p. 918.

Both rachitis and scrofula exert a specific morbid influence upon the intimate structure of the osseous tissue, and in consequence of that morbid influence gives rise to deformity. I must, therefore, endeavour to explain the manner in which this is effected.

The bones, as you are aware, in addition to their function of supporting the weight of the body, perform in the animal economy the office of a series of levers, which receive and vary the direction of the power exercised upon them by the muscles, for the due performance of which offices, a degree of strength is requisite, in proportion to the force to be resisted.

The strength of bone depends upon the due admixture of an organic with an inorganic material, the latter of which is deposited within the areola tissue or cells composing the former, and the proportions of the two, as found by chemical analysis, are as follows :—

			Berzelius.		Middleton.
Animal Matter ...	Blood Vessels	1·13	33·30	...	33·43
	Cartilage	32·17			
Phosphate of Lime			51·04	...	51·11
Carbonate of Lime [124]			11·30	...	10·31
Fluoride of Calcium...			2·00	...	1·99
Magnesia, wholly or partially in the state of Phosphate...			1·16	...	1·67
Soda and Chloride of Sodium			1·20	...	1·68
			100·00		100·19

The proportions between the organic and inorganic elements composing healthy adult bone are, therefore, roughly computed, as one of the former to two of the latter; but these proportions vary at different periods of life. According to Berzelius and Dr. John Davey, at the age of 15 the proportions of the constituents (as seen in the following analysis by Dr. John Davey) are not one to two, as in the adult bone, but nearly equal in quantity to each other. If the examination of the relative proportions of these elements was carried lower down the scale of life, we should arrive at a point at which the earthy matter would cease to exist altogether; for example, in the fœtus.

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[124] The carbonate (of lime) is said by Denis to exist in larger proportion in the bones of children.— *Jones Quain, Elements of Anatomy*, edited by *Quain & Sharpey*, 1843. Introduction, p. cxxxvi. v. 2.

	Berzelius. Adult Bone.	Dr. John Davey. Fifteenth Year of Age.
Animal Matter	33·30 ...	46·4
Earthy Matter	66·70 ...	53·6
	100·00	100·0

The mode in which the organic and inorganic elements are united in the composition of a bone is a matter that I must not pass entirely by in silence, inasmuch as the diseases that are especially under our notice at the present time, *viz.*, rickets and scrofula, especially consist in a derangement of these elements both as regards their relative proportions and the manner in which they are blended the one with the other. That bone consists of the two elements I have described is easily demonstrated by submitting a bone to the action of an acid, in which case the whole of the earthy particles become dissolved out from the organic network, leaving the part exactly the shape it was before it was submitted to such an action. It is, however, soft and pliable, and (if it is a long bone) it may be tied in a knot, as if it were a rope;—or, on the contrary, to the action *of fire*, in a crucible. In this case the entire animal matter is destroyed, and the inorganic left. The bone is, nevertheless, still of the same shape, thus demonstrating the intimate manner in which the elements are intermingled the one with the other.

The experiments which I have mentioned, illustrate in a rough manner, two diseases, *viz.*,—one, mollities ossium, or, as it has been called, "rickets of adult life;" in which the bones are preternaturally soft; and the other, fragilitas ossium, in which the bones are extraordinarily brittle, and break with a mere touch. Both of these diseases I shall have occasion to bring before your notice hereafter; let us, therefore, examine by what means such a change in the bone can be effected during life.

Each bone, whatever its shape, is possessed of a greater or less amount of cancellous structure in its interior; and if it is a long bone, such as the humerus, of a central medullary cavity, in addition to the cancellous structure found at its extremities and in its epiphyses, all which parts are visible to the naked eye; moreover, *every portion* of the *solid* bony structure itself is made up of minute canals and cells; but these are only visible by the aid of the microscope.

The cavities thus existing within the structure of the bone, or in its interior as cancelli, or medullary cavities, are lined by a *vascular membrane*, the medullary membrane, or internal periosteum, whose function in health is, 1stly, to carry nutrient vessels to the bone, to secrete the fluid or marrow (medulla ossium) that is contained in such cavities and cells; and 2ndly, to deposit the earthy particles as growth proceeds; but in the diseases under consideration, the vascularity of this membrane, which, as I have told you, passes into the most minute portions of the bone, is greatly enhanced, and its functions are rendered abnormal, whereby the character of the secreted fluid in every part of the bone is changed from the ordinary medulla ossium into a sanguinolent,[125] gelatinous,[126] or a tuberculous matter,—and the deposition of the inorganic matter necessary for the growth of the part is arrested;—or, by a reverse action of the vessels, the earthy matter previously deposited is reabsorbed, whereby the bone is rendered thin and transparent, and in some cases as soft and pliable as if it had been steeped in acid.

That such an absorption of the earthy particles is effected in bone as the result of disease is a matter of certainty; and as proof thereof, I need only place in your hands a portion of the skeleton now present, (Diag. 21

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[125] Guérin states that this sanguinolent fluid is at first aqueous, next gelatinous, and subsequently that it becomes organised in the manner of a false membrane. His words are, "Lorsque l'on coupe en deux moitiés longitudinales un os rachitique de la première période, on trouve une quantité remarquable de matière sanguinolente épauchée dans le canal médullaire et au niveau des épiphyses." .... "A un degré plus avancé, la même substance fait place à un dépôt de matière gélatiniforme, qui s'organise à la façon des fausses membranes," pp. 29, 30.—*Mémoire sur les Caractères généraux du Rachitisme par Le Docteur Jules Guérin*, 1839.

[126] "The bones, during the active state of rickets, are found to resemble very vascular cartilage; the medullary cavities are filled with a bloody gelatinous-like substance in place of marrow; and the osseous texture presents everywhere, even in the cortex, numerous minute cells, from which a thin bloody fluid can be pressed."—*Cycl. Practical Med.*, vol. iii. p. 618. Article, *Rickets.*

is drawn from a part of the skeleton referred to), in which you will observe that the compact tissue of every one of the bones, instead of being opaque and solid, is transparent, and possesses little more thickness than a piece of paper;—or, refer you to the work on Anatomy by Monro (vol. i. p. 27), who states that in some cases of rickets he has known the proportion of the animal matter to range as high as 74, 75, and even 79 per cent.

Analysis by Dr. John Davey:—

	Dry Tibia not Rachitic.	Dry Rachitic Tibia.
Animal	46·4 ...	74·
Earthy	53·6 ...	26·
	100·0	100·

Monro's Elements of Anat., vol. i. p. 27.

In speaking of the increased vascularity of the membrane lining the cells, &c., within the structure of the bone, I have said that the abnormal secretion was either *sanguinolent* or *tuberculous*, and that the earthy particles deposited were either simply absorbed and the bone *thinned*, or that their absorption was carried beyond that point, and the bone rendered *soft* and *pliable.* In these few words I have conveyed to you the first, and, I may say, *the great difference* between rickets and scrofula, *viz.*, that in rachitis the healthy medulla ossium is converted by the diseased action of the vessels of the medullary membrane, or internal periostium, into a sanguinolent gelatinous fluid; *or*, according to Guérin, into a sanguinolent serous fluid, which afterwards becomes gelatinous, and ultimately organised as a false membrane; and that accompanying such changes in the medulla ossium, the earthy particles of the previously formed bone are removed, and the bone rendered so soft and pliable that it is no longer possessed of the power requisite to bear the weight of the body, or to resist the action of the muscles (see Diagrams 15, 16, 17, 30, and 81). On the other hand, in *scrofula* the medulla ossium is converted *not* into a *gelatinous* or *sanguinolent fluid*, but into the true *tuberculous* matter, which is so characteristic of *scrofulous disease* ;—and 2ndly, the absorption of the earthy constituents never proceeds to such an extent as to render the bones *soft*, as in rachitis, but only to that point at which their walls are thinned, by the absorption of both the organic and inorganic matter, as in the skeleton present.[127] In Rickets, the deformities which are produced are the result of the simple yielding of the bones to the weight of the body, or, to the force of the muscles acting upon them, without any loss of substance externally from abscess, caries, or other causes. In Scrofula, on the contrary, the deformity is the direct result of inflammation and its consequences, *viz.*, abscess, caries, or necrosis in the substance, or articular extremities of the bones ;—or scrofulous deposit, inflammation, and suppuration directly or indirectly affecting a joint.

From the observations I have now made, I think you will admit that there are valid reasons for the opinion that I have expressed, that rickets and scrofula are not essentially the same disease, as enunciated by Sir Charles Bell, and that they each present distinctive characters which are peculiarly their own, by which they manifest themselves externally. There are, however, other characters in which they equally markedly differ, as I shall presently point out to you.

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[127] The skeleton here alluded to is represented in Diagram 21, p. 26. All the long bones of this skeleton are so thin that they are translucent when held up to the light.

In the last Lecture I demonstrated to you that rickets is a disease of uterine life, I have now to enter upon its consideration as a disease of infancy and childhood.

Rickets, whether originating *before* or *after* birth, is essentially a disease of *imperfect nutrition;* but whether that imperfect nutrition is the result of the specific action of the disease, or is in itself the absolute cause of all that results therefrom, it is not so easy to determine. I cannot, however, refrain from offering an opinion which I have long entertained, *viz.*: That *in all cases* rickets originates during *uterine life*, *i. e.*, while development is going on, and while the basis of the osseus tissue is being laid down, and its constitution, as it were given to it;[128]—in fact, that the numerous cases which we see apparently originating during infancy are in reality simply *congenital* cases, in which the disease was for a brief period dormant (as Phthisis is known to be during pregnancy), and permitted the luxuriant force of growth during the first few months of life to overpower its baneful influence, and to give rise to the plump appearance seen in infants generally;—but, that in all these cases, as soon as the system of the infant ceased to receive

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[128] Quain, in the Introduction to his work on Anatomy (1843, p. cxlv.), states:—"The bones do not at first contain marrow; in the fœtus their cavities are filled with a transparent reddish fluid, like a bloody serum, only more consistent and tenacious."

The fluid in rachitic bone appears therefore a reversion to the condition of the fœtus. Query: May not the persistence of that quality of the medulla ossium be the real cause of the disease in infancy?—E. J. C that best of all infantile food, *the mother's milk*, and was subjected to the ill effects of improper diet, and the irritation of teething, the disease resumed its activity and asserted its powerful agency upon the skeleton generally, in the tissue of which its germ had been already implanted during uterine life. This idea is moreover materially strengthened by the fact that rickets is *unquestionably hereditary*;[129] in which case the morbid taint must have passed direct from the parent to the ovum and influenced every stage of its development.

The idea that rickets may remain dormant is somewhat borne out by the author of the article in the *Cyclopædia of Medicine*, vol. iii. p. 620. He says:—"Sometimes rickets in adults, or mollities ossium, is merely a protracted form of infantile rickets, which has continued with numerous checks and interruptions, and successive revivals and increase of symptoms, even to advanced life." Surely if a disease can continue in this manner from infancy to advanced life, it is not too much to assume that it may go a few *months* further back than infancy, *viz.*, to uterine life, *i.e.*, be in all cases a congenital affection.

The period of life at which rickets first manifests its deleterious agency, sufficiently distinct to attract the parent's attention, I have made the subject of especial study, and for this purpose I have kept a register of 600 cases by which it appears that upwards of two-thirds of the entire number were noticed in the first year. It is, therefore, especially a disease of infancy, and its cause must originate immediately after birth, if it be not in reality the persistence of a congenital *disease*, as I am inclined to believe it.

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[129] Rachitic children have always bad teeth. How is this? This is surely from some *original* (constitutional) cause, not merely imperfect nutriment subsequent to birth. .... That rickets is hereditary I am fully assured.

TABLE No. 1.

Age at which Rickets was first noticed.

	E. J. C.'s Register.	
Birth ...	108	= 472
6 months ...	96	
1 year ...	268	
2 ,, ...		96
3 ,, ...		28
4 ,, ...		4
5 and upwards		0
		600

	Guérin's Table.
Before Birth	3
1 year	98
2 ,, ...	176
3 ,, ...	35
4 ,, ...	19
5 ,, ...	10
6 to 12 years	5
	346

Rachitis was also made the subject of especial enquiry by Docteur Jules Guérin, in Paris—and I have, therefore, extracted from his most excellent Mémoire upon it, published in 1839, the table which is by the side of my own.

The conclusions to which we have both arrived, though not exactly alike, are sufficiently so to demonstrate the fact that the vast majority of cases of rachitis occur *under two years of age*—according to my own experience, 472 out of 600 were observed within the first year of life; of this number 204, or one-third of the whole, before six months; and 108 were noticed by the mothers within the first month of life, for which reason they maintain, and I think justly, that the children were born so. It is, however, an astonishing fact, that in many instances the parents of children 5 or 6 years old, and severely deformed by rickets, will seriously tell you that "*they* had only observed it a few months," whereas it is quite certain, from the severity of the deformity produced, that it must have been for years. According to Guérin, the greatest number originated between the first and second years, and a quarter of the whole number were noticed before the first year—and of these, three were at birth. After the second year of life, according to Guérin's experience, and after the first year, according to my own, the cases progressively run thus:—

TABLE No. 2.

3rd Year.	4th Year.	5th Year.	6th to 12th Tear.	12th Year and upwards.	
28	4	0	0	0	My own.
35	19	10	5	0	Guérin.[130]

The facts established by these tables, in *my judgment* very materially support the opinion I have advanced, that rickets is always a congenital disease, which has merely been arrested for a time, and revived again a few months after birth.

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[130] Guérin remarks, in reference to the table I have placed before you, that Rachitism, properly so called, is a disease of infancy. His words are:—"Le rachitisme proprement dit est une maladie de l'enfance; on l'observe rarement sur le fœtus, le plus fréquemment vers l'âge de dix-huit à vingt mois, très rarement après l'âge de la puberté."—*Mémoire sur les Caractères generaux du Rachitisme*, pp. 13, 14.

I do not believe the statements of those parents who say their child was only affected at 3, 4, or more years of age. I have seen numerous cases in which this has been told me, but in which the severity of the deformations of the various parts of the skeleton has demonstrated most forcibly that it had existed for years, although the unobservant relations had entirely disregarded it. The same thing also is frequent with disease of the spine.

The next point illustrated by the register I have kept, is the fact that the disease makes its attack irrespective of sex. In this point also Guérin arrives at the same conclusion, thus:—

TABLE No. 3.

	E. J. C.	Guérin.	United.
Male	310	148	458
Female	290	198	488
	600	346	946

The slight variation in the number of males is not sufficient to be worth notice; indeed, if we add the two tables together, the difference between the sexes is still less.

I must now draw your attention to the disease itself, *viz.*, rachitis as it manifests its action in the different parts of the skeleton; and to the deformities to which it gives rise; and in doing so I shall commence by giving you an account of its ravages upon the fœtal skeleton.

Montgomery, the author of the article "Fœtus," in the *Cyclopædia of Anatomy and Physiology*, informs us that "Pinel has given an account of a ricketty fœtus of eight months, in which the deformity was chiefly confined to the lower extremities." That "Chaussier examined another at the Maternité at Paris, in which there was distortion of the back and thorax, with softness and flexibility of the bones." But the fullest account that I am acquainted with, is given by Mr. Tamplin, in his work "On the Nature and Treatment of Deformities," p. 193. It is as follows:—"I have been fortunate enough to meet with a specimen (of rickets) in a seven months' fœtus, of which this is the skeleton; and you will observe that the long bones of both the upper and lower extremities are about twice their natural thickness, and about a third, or perhaps more nearly one half, shorter[131] than natural; that the tibia and fibula of both legs are curved[132] severely, the fibula outwards, the tibia inwards; that the radius and ulna of both upper extremities are also curved outwards and inwards; that the ilii and scapulæ are enormously hypertrophied, and the head, as is usual, very nearly twice the natural size; the parietal suture ankylosed at its middle third, and talipes varus of both feet. The extremities of all the long bones generally enlarged, having more the appearance presented in the skeleton of the elephant." Of this case Mr. Tamplin remarks:—"I have not been able to trace the history of the parents, which renders it somewhat incomplete, although no doubt exists in my mind of its being hereditary."

The deleterious influence of rickets upon the skeleton of the *infant* becomes manifest at various periods; but according to my own experience (see table No. 1), most frequently within the first year of life—and the parts most commonly first observed by the parents to be affected are the legs and arms, as will be seen from table No. 4.

There can be no doubt that the intimate structure of every part of the skeleton is influenced by Rachitis, but that influence manifests itself externally by the production of deformity at different periods, and with different degrees of rapidity, according to the conditions in which the infant is placed—sometimes tardily, and then perhaps only in the wrists and legs—on other occasions rapidly, and in these cases almost all parts of the skeleton show evidence of its presence. Thus, in 600 cases, the parts of the skeleton that were deformed *at the time the child was first brought under my own notice* were as set forth in table No. 6; and the number of parts of the skeleton affected in each child is shown in table No. 5.

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[131] The limbs of a fœtus of seven months are normally disproportionately short as compared with those of a child.

[132] Rachitis curvature is, therefore, demonstrated to be a congenital deformity.

TABLE No. 4.

Parts first noticed by the Mother to be affected in 600 Cases.

Leg	420
Arm	202
Spine	28
Chest	20
Head	20

TABLE No. 5.

Parts of the Skeleton affected at the same time in 600 Cases as noticed by myself.

Deformity in	2	parts of Skel.	93
Do.	3	do.	88
Do.	4	do.	160
Do.	5	do.	76
Do.	6	do.	56
Do.	7	do.	40
Do.	8	do.	36
Do.	9	do.	16
Do.	10	do.	16
Do.	11	do.	20
Do.	12	do.	12

The above (table No. 4) was the Mother's statement:—They had doubtless overlooked the enlargement of the wrist; it was always enlarged when the child was brought to me. In 90 cases it was stated to have been noticed in 2 parts of Skeleton: hence the table appears to be of a larger number than 600.

According to the tables I have now brought before you, the parts most frequently deformed by rickets are the legs and arms; but the legs are usually deformed to a much greater *degree* than the arms. Thus in 600 cases (see table No. 6, p. 198) there were 396 cases of knock-knees, 368 of curvature of the tibia and fibula, and 142 of curvature of the femur; and in this number a great proportion (216), say nearly half, both knock-knees and curvature of the tibia and fibula, existed in the same case; in 142 cases curvature of the femur existed as well.

TABLE No. 6.

Relative frequency of Rachitic Deformity in different parts in 600 Cases.

In the Lower Extremities		600
Spurious Valgus	28	
Enlargement of the Malleoli	300	
Curvature of the Tibia and Fibula	368	
Knock-Knees (in 216 there was also curvature) ...	396	
Curvature of the Femur	142	
In the Upper Extremity		600
Enlargement of the lower extremity of Radius and Ulna	600	
Curvature of the Radius and Ulna	60	
,, Humerus	36	
,, Clavicle	120	
Curvature (*ab*normal) of the Ribs (Narrow or Pigeon Chest)		156
,, Spine		108
Deformity of the Pelvis		16
Deformity of the Head...		296
Fontanelles Open		400
,, Closed		200

That the legs should suffer in this disease more than any other part is perfectly comprehensible, if we bear in mind that the essential characteristics of rickets is a softening of the bone, and that the *bones of the leg have to bear the weight of the body* in the first attempts of the child to feel its feet and walk, *as well as to resist, as levers, the force of the muscles.* This fact, I think, is quite sufficient to account for their frequent deformation, without having recource to the supposition maintained by Guérin, that they are in themselves more prone than other parts to take on the abnormal action.

That the bones of the arm equally experience the morbid action of rachitis, the table No. 6 demonstrates; for it proves that in *every case* examined the lower extremities of the radius and the ulna were enlarged, and that of these in 120 cases the clavicles were curved abnormally; in 60 the bones of the fore-arm were affected by curvature; and in 36 instances the humerus itself was also bent.

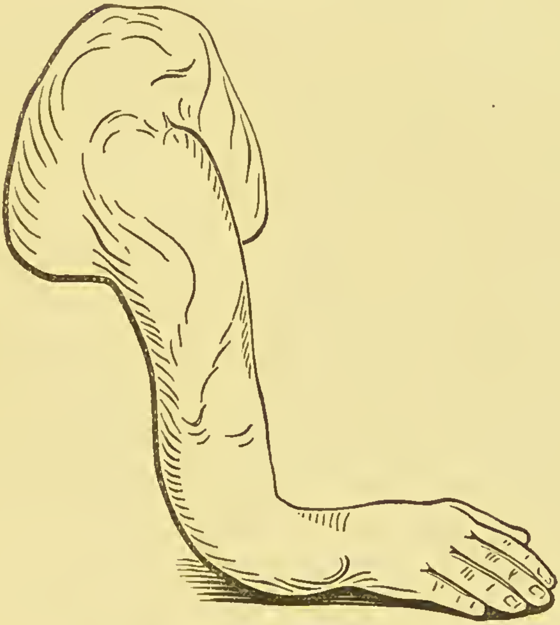
The enlargement of the lower extremities of the radius and ulna, or as it is spoken of, "of *the wrist*," to which I have drawn your attention as existing in every case that I have examined, is, in my opinion, *characteristic* of *rickets;* indeed, I know of no other disease in which it exists; and if, on examining a child, you find such an enlargement of the wrist, you may be prepared for all that follows, if you do not immediately have recourse to the appropriate means to arrest the further progress of the disease. In the vast majority of instances, however, you will find at the time you discover the affection of the wrist, that there is also a tumid belly, a curved leg, a contracted chest, or bent clavicles.

The proportion of the cases in which *curvature* of the *bones of the arm, and clavicle exist*, though not so great as curvature in the leg, is yet sufficient to attest the early period at which those parts succumb to the morbid influence; and if in addition to this circumstance we take into account the fact that in each case the deformity is the simple result of the inability of the softened bone to perform its office of a *lever*, and to resist the force of the muscles acting upon it, we shall easily understand the reason why curvature of the bones of the arm is not so frequent as of those of the leg, in which latter part, the bones have to resist not only the force of the muscles, but likewise the superimposed weight of the body ; and hence, we shall be led to the conclusion, that in all cases, the bones of the superior extremities, although not so much and early *deformed*, are as much *affected in their intimate structure* as the bones of the leg, the evidence of which fact is furnished by the enlargement of the wrists.

Curvature of the bones of the arm will be found to exist only in those cases in which the disease has progressed to such a considerable extent, that the bones have become much softened; inasmuch as until this is the case, the muscles acting alone have not the power to bend the bones to which they are attached; but no sooner does the bone begin to yield, than the muscular force exerted upon it acts with increased advantage, and as a consequence, the curvature is quickly increased to the full extent that the muscles can act. If, however, the child has been neglected and allowed to crawl much about on the ground, in this case the weight of the body is also brought to bear on the arm, and a far more severe degree of deformity than would be possible from muscular action alone is the result. See Diagram 81, which is drawn from a cast of such a case.

The relative frequency of *curvature* of the bones of the superior extremity is shown by the table to be as follows, out of 600 cases:—*viz.*, 120 cases of curvature of the clavicle, 60 of the radius and ulna, and 36 of the humerus. The importance of the clavicle is here well marked, as its function of holding the arm apart from the body, and forming a fulcrum upon which the arm is enabled to perform such multitudinous movements, exposes it (the clavicle) to resist much pressure, which pressure acts upon it in its softened state with great advantage from its *normally-curved* shape; and the consequence is, that it yields and becomes curved sooner than any other bone of the superior extremity, thus 120 times for 60 of the radius, &c.

No. 81.



81. The right Arm of a Child severely distorted by Rachitis. The Clavicle and Humerus are both extremely curved. The Radius and Ulna are bent to a right angle, and their extremities much enlarged. The left Arm was equally distorted.

The parts of the skeleton which in the order of frequency suffer most, subsequently to the affection of the extremities, are the head, the ribs, the spine, and the pelvis.

The order in which the various parts of the skeleton become deformed, according to Guérin, is as follows:—

viz., "1stly, swellings of the epiphyses of the inferior extremities; 2ndly, deviations of the knee; 3rdly, curvature of the tibia and fibula; 4thly, curvature of the femurs; 5thly, swelling of the wrists and deviations of the pelvis; 6thly, swelling and deformity of the ribs, scapula, clavicle, and spine; 7thly, the development of cranium and swelling of the bones of the face." He says that in 42 cases that he has observed, the disease manifested itself 41 times by the swelling of the articulating extremities, and curvature of the inferior extremities; in *one only* the affection appeared to begin by a deviation *of the spine*;[133] in none by the deformation of the chest.

He also says:—"It is an incontestible law, that suffers hardly any exception, that rachitis proceeds in the deformation of the skeleton from below upwards, and that deformity of the spine is the last to manifest itself." My own opinion, arrived at from the study of the thousands of cases that have been brought before me at this Institution, is, however, not exactly in accordance with this order of succession.

I have already told you that I consider swelling of the epiphyses of the radius and ulna *as characteristic of rickets*, and that it has been present in every case that I have examined.[134] I have also given you my reasons for thinking the bones *of the superior extremity* as much affected in their intimate structure, *i.e.*, as much affected by the disease, as the bones of the *inferior extremity.* However, as far as the *external manifestation* of the disease by *curvature* goes, the inferior extremities certainly afford that evidence before the superior, and the order in which they do so is shown in Table 6, *viz.*, 396 cases of knock-knees, 368 curvature of tibia and fibula, 300 enlargement of the ankles, 142 of the femur ; of these cases 216 were knock-knees and curvature, and 170 curvature without any affection of the knees.

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[133] See Table No. 1. In my own experience, 28 cases in 600 began in the spine.

[134] Swelling of the malleoli, however, has not been present in more than one half the cases; thus clearly demonstrating the inferior extremities are not more affected than the superior.

According to Guérin, the next part deformed after the thighs is the pelvis and wrists, which is contrary to my own experience, for out of 600 cases I only found 16 affected in the pelvis ; and of the wrists I have already spoken. This great discrepancy between our experience arises, I have little doubt, from the fact that his table was drawn up from admeasurements made *of skeletons in the different anatomical museums*, in which none but severe and old standing cases would be likely to be preserved ; whereas my table is an account of living cases as they were brought before me.[135]

According to my own experience, next in order to the limbs, the head is the part in which the deformity is most frequent ; and so much is this the case, that you can often recognise them as they are brought up to you before you ask a question. I was therefore somewhat surprised to find it stated that such a deviation "comes only in the last place."

After the head, the deformity next in frequency is curvature (*ab*normal) of the ribs; next, of the spine; and, lastly, of the pelvis.

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[135] If deformity of the pelvis was as frequent as Guérin states, it would very much more frequently be found to be an obstacle to delivery than is the case.

You must not, however, suppose that rickets invariably attacks the parts in the precise order mentioned, and the same parts in every subject, inasmuch as this is not the case. For example, in table No. 5, you will observe that occasionally it occurs in two parts of the skeleton at the same time; now these two parts may be the wrist and tibia, or the wrist and knock-knees, or wrist and chest. Again, in other instances it exists in three parts, in which case it may be the wrist, the knee, and the spine; or the wrist, the knee, and the ankle; or the wrist, the knee, and the head; or the wrist, the knee, and chest; or the wrist, the tibia, and the chest; and thus with all the other examples.

There is yet another point of interest beyond the softening and curvature of the bones, *viz.*, that the skeleton generally suffers an arrest of development, so that its parts never acquire their normal proportion. Sir Charles Bell, in reference to this subject, says:—"The bones are found to be blighted and limited in growth." Again, "If the dwarfs be not distorted or ricketty—yet they have partaken of this one quality of rickets—there has been a blighting, or at least a want of development, of the lower part of the body."—*Lancet*, vol. i. p. 965, 1833-4.

From an examination by actual admeasurement of rachitic bones in various museums, it was found by Guérin that a diminution in length was so constant, that he affirmed, "That the dimensions of a rachitic bone being known, the dimensions of the other parts of the skeleton can be approxitively determined." The result of these admeasurements is shown in table No. 7.

TABLE No. 7.—From Guérin.

	Os Rachitiques.		Os Normalex.		Differençe.		p. 100
1° Péronés	9*p*	5*l*	13*p*	2*l*	3*p*	9*l*	= 28
2° Tibias	10	1	13	6	3	5	= 25
3° Fémurs	10	11	14	0	3	1	= 22
4° Radius	6	8	8	4	1	8	= 20
5° Cubitus	7	6	9	3	1	9	= 19
6° Humérus	8	11	10	6	1	7	= 15
7° Clavículos	5	2	5	8	0	6	= 9
8° Sternum	5	0	5	5	0	5	= 8
9° Colonne	20	11	22	0	1	1	= 5
10° Trois diamèters du Bassin	11	9	13	6	1	9	= 17

I cannot speak upon this subject from any actual admeasurements that I have made myself of those under my care, but the opinion that I have formed upon it from an examination of some thousands of cases of rachitic deformities, is decidedly, that rachitic children are not as tall, as children of the same age who are not so affected.[136]

As I have now concluded the remarks I have to make upon the changes effected by rachitis in the structure and shape of the various parts of the skeleton, from the absorption of the bones' earth, I must not omit to inform you that on the cessation of the disease, the inorganic elements of the osseous tissue are redeposited, and that the bones re-acquire their strength; indeed, not only is an amount of earthy salts deposited, which is equivalent to those previously removed, but in addition thereto, such an extra proportion that the bones acquire a degree of massiveness,[137] and strength,[138] that is never possessed by them in a normal condition. Upon an examination of such a bone, its texture will be found to be much more dense;—and *if* the bone examined be curved, there will be seen an abnormal amount of this dense bone deposited in the *interior* of that curve, as if it were to compensate for its weakness in that part. If such a bone be cut across transversely, the increased deposition of earthy matter will be found inside as well as outside; and in some cases the quantity is so great that the medullary cavity is entirely obliterated, *i.e.*, filled up by it. In the leg, the tibia and fibula will often be found united by an abnormal process of bone passing from one to the other, thereby increasing their strength, as seen in the specimen present. In many cases, however, the bones will be found to have been very materially altered in shape ; for example, the tibia will be found so compressed from side to side that a thin and sharp edge presents anteriorly.

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[136] A striking example (Mr. Weed's child, Helborn) of this diminution in height has been brought before me lately. In this case the child is 10 years old, and yet she is only an inch taller than her sister, who is not yet four. The rachitic child is the offspring of a first wife; the younger one, of a second. .... In a case also recently under my care (1861), a youth 14 years of age has all the appearance of a child of 5. He is carried in the arms, and sits in the lap of his friends. The voice and genitals are the only parts proportionate to his age.

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[137] "The bones have become enormous."—*Sir C. Bell. Lancet*, 1833–4.

[138] In the Museum of the Royal College of Surgeons there is a portrait of a rachitic dwarf named Farrell, or "Leather Coat Jack," as he was called, who it is asserted was so strong that for a pot of porter he would allow the wheel of a hackney coach to go over him. Sir Charles Bell, in speaking of this dwarf, says—"He possessed such an extent of strength that he could put his arm under the thighs of the tallest man, and so carry him. He exhibited great feats of strength, such as bearing an anvil on his breast."—*Lancet*, 1833–4, vol. i. p. 919.

The tendency to abnormal deposition of the earthy salts of bone, or hyperostosis, when once induced does not always cease to exert its influence directly the weakened bones have been resupplied with earthy matter ; on the contrary, we frequently find exostoses and bony spiculæ of considerable size which produce great inconvenience. I have often seen this on the upper part of the spine of the tibia, just below the knee.

Of this excessive deposition of bone in abnormal situations there is a most interesting specimen in the Museum of the Royal College of Surgeons of England, in which the bones of the extremities are united to the trunk by large and long spiculæ passing across from part to part in the most extraordinary manner, and thereby rendering the movements of those parts an impossibility. The man, from whose body this skeleton was obtained, was an inmate of a workhouse, and the only use to which they could put him was to stand him in a sentry box to watch the other men, and to keep them to their work by his outcry against them if they stopped. There is another case of the same kind narrated in the "Philosophical Transactions" for 1740-41. In this case every bone in the body had been *distorted by rickets* in childhood, and began to grow stiff when 18 years old, and soon became like a statue. He lived in this miserable condition to be 61 years old. His skeleton was preserved, and the most extraordinary growths of bone were found passing from the adjacent parts to each other.

Rickets of Adult Life.

When the active stage of rickets is not arrested in infancy or youth, it passes on, according to Cumin, after repeated interruptions and revivals, to the production of such an amount of softening and absorption of the bones that they become little more than a mere case, and assume all manner of distorted forms. This disease of the adult is known as "Mollities Ossium." Other authorities however deny that mollities ossium and rickets are the same disease, for example, Sir Charles Bell, after narrating a case in which a man was so much affected that "he rose in bed with his heels behind the back of his head, by which time the tibia and fibula had also given way," says, "mollities ossium is not rickets; rickets is altogether a different disease."

This disease, fortunately for humanity, is so rare that I have no personal experience of its peculiarities to record, not a single case has presented itself at this Institution, and for that reason I shall not dwell further upon it, but pass on to the consideration of the next disease on our list, *viz.*, Scrofula.

Scrofula.

The morbid influence exercised by scrofula upon the skeleton I have already pointed out to you in speaking of rickets;—*viz.*, that the medulla ossium is converted by its action into true tuberculous matter, and that the earthy constituents of the bone are so much absorbed that the bone is rendered weak and thin, as seen in the bones of the skeleton present, in which all the long bones are absolutely translucent.

In scrofula, *as in rickets*, the absorption of the earthy particles of the bone takes place in every part of the skeleton, whereby the bones are rendered lighter and more fragile, but in scrofula the bones do not become soft, and yield under pressure, as the animal matter is equally absorbed with the earthy particles, whereby the bones are merely rendered thinner as in the skeleton I have before referred to:—moreover, in scrofula they suffer no diminution in length; nor subsequently any increase in bulk, from abnormal deposition of earthy matter. In scrofula, also, as in rachitis, the abnormal secretion occupies the various cavities within the bone;—but the parts in which the tuberculous matter is at first deposited, and the period at which such matter, when deposited, first takes on an active stage is precarious, as the disease appears to follow no regular course.

Sometimes the deposition of tuberculous matter is confined to a particular part; at others it occurs in several parts indiscriminately at, or about, the same time; and these under very slight excitement become inflamed and suppurate, causing abscesses in the cancellous structure; necrosis of the shafts; or ulceration of the articular cartilages; as seen in the numerous cases of diseased joints and bones, that are to be met with in every hospital. In these latter points, therefore, scrofula is clearly contradistinguished from rickets.

An illustrative instance of this precarious deposition, inflammation, and destruction of parts, is under my care at the present moment (April 27th, 1859). The patient, a little girl, is 4 years old.[139] The mother states that

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[130] Mary Ann Durham, "Diary" 98 B.

when her child was only three months old a swelling came on the outside of the left ankle, and a little time afterwards another on the inner side of the same ankle. That these swellings soon burst. A succession of 15 such swellings made their appearance in as many months. They were situated on various parts of the left leg, on the outside of the right thigh, on the right side of the neck, and on the hands. They all suppurated and burst. Some have healed, but several remain open at the present time. The child had also disease and opacity of the eyes and discharge from the ears. The actual condition of this child as it bears upon our present subject is as follows:—There is caries of the lower extremity of the tibia and fibula of the left leg;—also of the same tibia just below its tubercle. The metatarsal bone of the fourth toe of the left foot is evidently diseased, and there is a sinus leading down to it. The first phalanx of the middle finger;—the metacarpal bone of the same finger, and the first phalanx of the thumb of the left hand are each necrosed. The first phalanx of the little finger of the right hand is in the same condition. The bones of the ear are diseased.

This case, one of many such that have been thus early in life under my own care, points out, in a most marked manner, the characteristic difference between the action of scrofulous disease, and rachitis, *on the bony tissue*, to which I alluded in a former part of this Lecture. In this case, one of undoubted scrofula, all the bones were free *from curvature.* Even the tibia that had suffered a partial destruction of its shaft, maintained sufficient strength to support the body and to resist the force of the muscles; while in all the cases I have exhibited to you of rachitis, there was not a *single instance* in *which the surface of a bone was affected with suppurative disease*, or had suffered a breach of continuity. In one and all (*simple fracture excepted*), there existed this great and peculiarly distinctive feature, contra-distinguishing them from scrofula, *viz.*—That they were the simple result of the yielding of the softened bone to a force that normally they were intended to, *and could*, withstand ;—and that in every case, although the external *form* of the bone was much changed, yet nevertheless the integrity of the *external* surface of the bone was intact.

SYNOPSIS OF LECTURE VI.

Continuation of the Causes of Acquired Deformities.—1stly, Causes capable of acting indirectly on the Skeleton, by affecting the contractile Power of the Muscles—Alternate Nature of Muscular Action—Spontaneous Elongation of Muscles during the Contraction of their Antagonists—Sir Charles Bell's experiment in proof thereof—Mr. Mayo's opinion—Mr. Bowman's "passive contractility"—Exciting Causes of Muscular Action—Causes inducing excessive Muscular Action, or Spasm—Causes inducing Deficient Muscular Action, or Paralysis—Anæsthesia—Causes inducing Irregular Muscular Action, before and after Birth, alike in their Nature—2ndly, Disease or Injury of the Muscular Tissue—Inflammation of the Muscular Tissue and Nature of the Changes induced thereby—Nature of the Changes induced by Rheumatic Inflammation of the Muscles, or of their Sheaths and Fasciæ—Changes effected by prolonged Disuse of a Part—Direct Injury of the Muscles, as Wounds, &c., inducing a positive loss of Muscular Substance—Abscesses in the neighbourhood of, or Substance of the Muscle—3rdly, Causes inducing Deformity by opposing a Mechanical Impediment to the Action of the Muscles—Contraction of Skin—Idiopathic; or induced by Injury—Powerfully contractile property of a Cicatrix—Deformities induced by Burns and Scalds—Hypertrophy of the Skin—Contraction of the Fasciæ—Contraction of the Ligaments—4thly, Causes inducing Deformity by failing to afford the normal Support—Relaxation of the Fasciæ—Relaxation of the Ligaments.

LECTURE VI.

CONTINUATION OF CAUSES OF ACQUIRED DEFORMITIES.

In my last Lecture I concluded the consideration of the nature of those causes of deformity which give rise to it by a *direct* action on the skeleton itself;—to-day, I have to commence an examination into the causes which are capable of doing so *indirectly*, *viz.*, by acting primarily upon the muscles, &c. &c.

The bones, or component parts of the skeleton, are denominated the passive organs of locomotion; the direct active organs or agents by means of which the bones are moved from one position to another, are the muscles.

Whatever movements are practicable between any two bones, as they are bound together by the ligaments in the natural skeleton, are the movements which are *natural to*, and *normally possessed by*, each joint; accordingly, we find a series of muscles, or active organs of locomotion, so arranged around, and attached to such bones, as to be capable by their action of producing each of those movements. Each muscle acts upon the bone or passive organ, and pulls it in the direction of its force, in a purely mechanical manner.

In fact, it performs upon it just the same part that the rope pulled by the seaman exercises upon the spars and masts of his vessel.

As the action of the muscles upon the bones is thus purely mechanical, let us examine a joint clothed by its muscles, and ascertain the part performed by each of them, as it will very materially assist our comprehension of many of the deformities we shall have subsequently under our consideration.

For the purpose just alluded to, let us take one of the most simple joints, *viz.*, the articulation between the humerus and the ulna, between which bones the only motions practicable are simply those of flexion and of extension; and let us commence our enquiry by assuming that the powerful muscle in the front of the humerus (the brachialis anticus) is first put into action.

As the result of all muscular action is the shortening of the fibres of which the muscle consists, to a given extent (in the whole muscle about one-third of its entire length; in individual fibres it is stated the power is possessed to about two-thirds), it follows of necessity that the two extremities of the muscle previously named, are brought nearer to each other, and consequently, as it is attached above to the humerus, and below to the ulna, that one of the bones is moved upon the other until the motion is arrested by the cessation of the action in the muscle itself; or by the natural limit which is put to such action in the form of the joint; a provision for which you are aware is made in this instance in the mode in which the coronoid process of the ulna juts against the anterior part of the humerus.

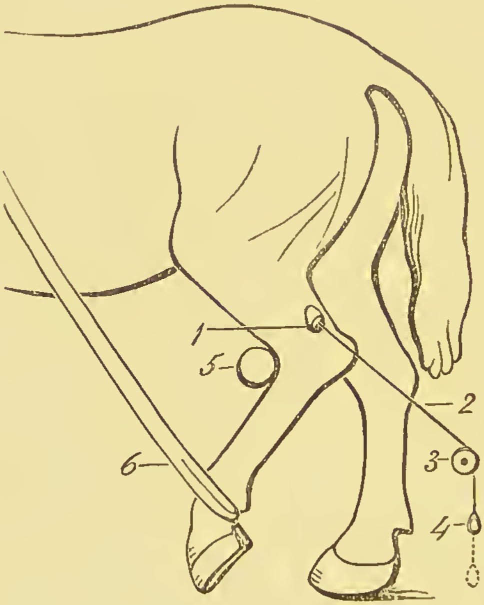
The joint being thus flexed, and a necessity having arisen for its extension, another muscle has to take up the action, and accordingly we find that the opposite side of the bone is occupied by the large and powerful triceps, the fibres of which, acting in accordance with the impulse of the will, and shortening, as in the preceding instance, causes the ulna to retrace its course back to its original extended position, a limit to which movement is also placed, by the mode in which the upper part of the ulna or anconeus juts against the back of the humerus.

The repetition of the movements just examined constitute flexion and extension, and of course alternate one with the other, and in each instance you observe it is performed to as great an extent as the conformation of the joint will permit.

As the muscles which have produced the movements just examined are equally powerful (at least, for our argument, let us assume they are), you will doubtless ask, how does it happen, when one of them is contracted, and fixes the bone in one position, that the other is enabled to overcome its contraction in addition to whatever other opposing force it may have to encounter? or again, supposing the joint in a state mid-way between flexion and extension, how are we to explain the fact, that either the one or the other muscle can act in obeyance of the will, the flexor overcoming the extensor; or, on the contrary, the extensor overpowering the flexor? These questions involve much that is most interesting and pertinent to our enquiry into the production of deformity. The answers to these questions, as furnished by physiological experiment, are at present surrounded by very much theory, and will perhaps ever remain in part a matter of conjecture; nevertheless, so far as they are within my own comprehension, I will attempt their explanation.

The most satisfactory explanation that ever I heard advanced upon the alternate action of the muscle, was brought forward by Sir Charles Bell, in a lecture, at which I had the pleasure of being present, at the Royal College of Surgeons, in 1833, in which lecture he adverted to an experiment he had performed on a horse, in illustration of which he had prepared a large diagram, of which Diagram 82 is a copy, made from a

No. 82.



E. J. C.

82. Copy from my Note Book of the Diagram of Sir Charles Bell's experiment, illustrating muscular action.
1, The divided tendon drawn out of the wound.
2, A fine string attached to the tendon, passing over.
3, A small pulley.
4, Weight attached to the string ;—the dotted lines show the point to which the weight descends.
5, Bar of wood preventing the Horse from moving his Leg forward.
6, Band passed over the Neck of the Horse, and holding the Leg from the ground.

sketch I took at the time in my note book. The experiment was as follows. A horse was firmly fixed against a wall, and the hind leg retained in an immoveable position by a bar of wood (Diagram 82, fig. 5) in front, and a ligature (fig. 6) attached to the foot. The tendon of one of the large extensor muscles of the hind leg was then divided, and the portion in connexion with the muscle was drawn out of the wound. A fine string, that had been previously prepared with a small weight at one end, was then fastened to the withdrawn tendon, and the string placed over a pulley fixed in a convenient position. The weight suspended by the string was far too trivial to have any effect upon the muscle, yet it would enable the experimenter to discern every movement of contraction, or elongation, that took place in the *divided* muscle; as the slightest alteration in the length of the muscle would be evidenced by a rising or falling of the weight.

The intention of the experiment was to ascertain whether any action took place in a muscle *during the contraction of its antagonist.*

Everything being now ready for the experiment, the ligature was removed from the horse's leg, and the limb permitted to be gradually contracted by the uninjured flexors, whereupon the weight immediately descended, marking distinctly that although the muscle was detached below from the bone, nevertheless that a *spontaneous elongation of its fibres* occurred *simultaneously* with the *contraction of the fibres* of its *antagonist.* The experiment was repeated several times, and each time with the same result, thus clearly demonstrating (if there was no error in the experiment, and one can hardly conceive that an error could occur in such an experiment, with so able an experimenter) that a muscle, for example, a *flexor*, has *not to overcome the power of its antagonist*, the extensor, as the *extensor muscle elongates itself spontaneously* at the *same moment* that the flexor is put into action; and as such is the case, it also demonstrates that irregular muscular action, such as is frequently witnessed, may result from an interference with either one of these powers, *viz.*, with *contraction*, or with the power of *spontaneous elongation.*[140]

The experiment which I have just narrated to you, appeared to me at the time, and does so now, most satisfactory, provided it is devoid of fallacy; and as I just now stated, I can hardly conceive such a man as Sir Charles Bell falling into any error in such an experiment, or wilfully mis-stating the facts. Moreover, Mr. Mayo, his contemporary, and absolute opponent in all physiological research relative to the nerves, in his "Outlines of Human Physiology" (p. 41), states:—"At the time of becoming relaxed, muscular fibres *always* exhibit some degree of *elongation*, which, however, in many instances, is extremely slight;" thereby corroborating the statement of fact made by Sir C. Bell.

The idea of the spontaneous elongation of the muscles during the action of their antagonists is not generally admitted at the present day, although it is just as comprehensible as *contraction;* on the contrary, the opinion is held that each muscle in acting has *to overcome* the "*passive contraction*" of its antagonist; for, according to Mr. Bowman's views, as expressed in the "Cyclopædia of Anatomy:"—"The passive contraction of muscles continually opposes their elongation by the action of antagonists, and restores them when that action ceases;" and again, in speaking of active contraction, he says:—"It (active contraction) is always excited by a stimulus, and is always exerted in opposition to another force within the body, which it is able more or less completely to master. The opposing force is generally the passive contractibility of antagonist muscles."

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[140] I have seen many cases in which the limb does not obey the will, nor permit another person to move it without force; *i.e.*, it can be either flexed or extended by a slight force in addition to the patient's efforts, *but not without.* In other cases, there is no loss of power in any of the muscles; yet upon the limb being either flexed or extended, there is always a momentary difficulty in assuming the opposite action.

Mr. Bowman, in the foregoing passage, says the passive contraction "restores them" when the active contraction ceases. How can it "restore them" when the "action ceases?" Supposing two muscles of equal power, one contracted to its utmost, and consequently the opposite or antagonist extended a proportionate amount; the moment active contraction ceases, the muscles are not altered in position by the cessation of the action in one; and if the equilibrium is restored by the passive contraction *alone*, how can that occur if passive contraction in the extended muscle is simply opposed to the passive contraction in a muscle that is contracted? for the passive contraction in both is equal, and causes each to assume the shortest possible position.

Of the existence of the property known under the term "passive contractibility," or "tone," for they are synonymous, there can be no dispute; but this does not in any way disprove the *periodic existence* of another property, *viz.*, that of *absolute yielding*, or of the *spontaneous elongation*, of the fibres of a muscle, *at the moment its antagonist is actively contracting*, which is the point established by Sir Charles Bell's experiment.

There are, however, some muscles, the action of which it is difficult to understand, without having recourse to this explanation of Sir Charles Bell's; for example, how can we explain the action of the muscular structure of the *ventricles* of the heart, which is *immensely more powerful* than that of the *auricles*, unless we admit the existence of some such property, by means of which the ventricles readily yield, or *spontaneously enlarge*, to permit of their distension with blood, preparatory to their active and powerful contraction? for if we attempt to explain it by the supposition of the power of the auricle, aided by the force of the blood itself, being sufficient to distend them, *i.e.*, to overcome the "passive contraction" of Mr. Bowman, we are met then by another difficulty, *viz.*, how to account for the distension of the *left* ventricle, the muscular power of which far exceeds that of the right ventricle, while the musculi pectenati in the auricle above it, are so few *in comparison with those* in the auricle above the *weaker right ventricle;* and also while the force of the column of blood pressing forward is so much less through the pulmonary veins into the left auricle, than through the ascending and descending venæ cavæ into the right; for it will surely hardly be advanced in argument that the *greater* force is necessary to overcome the *lesser* resistance, the conditions of the resisting parts in other respects being alike; or that a greater amount of muscular power is supplied to the right auricle, the ventricle appertaining to which is weak, in order to overcome its "passive contraction," than is supplied to the auricle, of the opposite side, the ventricle of which side is at least twice as powerful as that on the opposite; for if so, it will most certainly present an anomaly not to be found in any other part of the body.

The tongue, also, is an organ consisting of the most intricate *interlacement* of the fibres of a number of muscles, which fibres run in every direction; and, at the front part, or tip of the tongue, they are simply opposed to each other without bone, or other hard substance as a fulcrum. How extensive, varied, rapid, and accurate are the movements of the extremity of this organ! yet, all these movements are performed with a precision that can only be understood by admitting that each muscular fibre spontaneously elongates at the same moment its antagonist contracts.

The question of the existence or non-existence of the power of *spontaneous elongation*[141] in a muscle, at the moment of the *commencement* of *contraction* in its antagonist, is in my opinion set quite at rest, by the ingenious, easily performed, and conclusive experiment, detailed by Mayo in his "Outlines of Human Physiology," p. 43,[142] in which experiment the thick muscular ventricular portion of the heart of a dog, *divided from the auricle*, is seen to contract and *elongate* alternately for some period of time, thus demonstrating in the most conclusive manner that muscular fibre does *spontaneously elongate* (see Diagram 83) at the time of the active contraction of its antagonist; for in this experiment the antagonists of the ventricles, *viz.*, the auricles were actually cut away. The intention of this experi-

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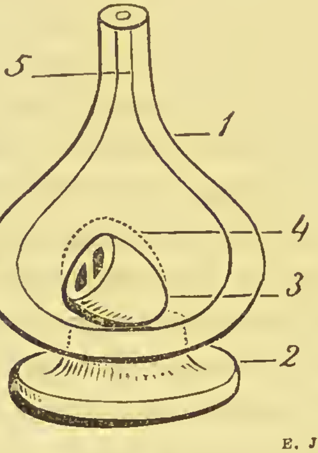
[141] Some time back, on moving my head sharply round one afternoon, I felt a sudden dart of pain down the back of the neck and shoulder, followed immediately afterwards by a glow of heat. For some days, the line of the pain was tender to the touch, and I concluded I had ruptured a few fibres of the Trapezius on that side. This rupture was the consequence of their not momentarily *spontaneously* yielding to the action of the antagonist.

No. 83.



83. Copy from my Note Book of the Diagram used by Mr. Mayo in his Lectures on Physiology at King's College, London.

1, Glass Vessel, with   2, Ground Stopper, serving as a Stand.
3, Ventricular portion of the Heart in a contracted state.
4, The Dotted Lines represent the size of the Ventricles when expanded.
5, The Height to which the Water ascends.

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[142] "The ventricular portion of the heart removed from a large dog immediately after death by hanging, was immersed in warm water contained in a glass vessel, which was closed below with a ground-glass stopper, and terminated above in an open vertical tube one-third of an inch in diameter. The ventricles continued alternately to contract and dilate for a considerable length of time, during which the water stood at the same level in the tube, totally unaffected by the varying condition of the muscular fibre."—*Outlines of Human Physiology, by Herbert Mayo, F.R.S.*, p. 43.

ment was to demonstrate that muscles neither gained nor lost bulk by contraction or expansion, which point was proved by the water in the neck of the flask remaining steadily at one level during the experiment.

Having thus laid before you the opinions entertained by physiologists upon this most interesting point of enquiry, I shall proceed to the consideration of the causes capable of impairing in any manner the power of the muscles, or of interfering with the agreement of action existing between them.

An impediment to voluntary muscular action, when the bones are properly united, and free to move upon one another, must occur from one of the following conditions;—1stly, from the existence of error, *viz.*, of an excess, or diminution, of the exciting power of contraction, as exemplified in the table, p. 44, in one or more muscles, whereby the necessary and natural agreement of action between the muscles of a part is destroyed;—or, 2ndly, from the existence of error, *viz.*, of disease, or injury in the muscles themselves; or in the parts contiguous to them; whereby changes are induced in the muscles, or their sheaths, which prevent them from exercising their proper function;—or, 3rdly, by error in the contiguous parts alone. Let us, therefore, proceed to enquire into the cause of each of these conditions.

The exciting cause of voluntary muscular action, is unquestionably the impulse conveyed to them through the nerves of sensation and of motion, known as the cerebro spinal, or diastaltic system. It therefore of necessity follows, that the existence of an excess, or diminution, in the contractile force of the muscular tissue, implies the existence of abnormal action in the nerves conveying that impulse; we have, therefore, to enquire what are the causes known to be capable of exerting such a deleterious agency upon the nervous system as to induce the excessive or irregular action of the muscles known under the terms spasm, and convulsions; or the opposite condition, *viz.*, loss of sensation or of motion in those parts; in either of which cases the same injurious consequences are the result, namely, an inability to use the part.

The loss of power in the *motor* nerves to obey the impulse of the will, or the warning impulse of sensation, gives rise, as you are aware, to a paralytic condition of the muscles of the part, under which all voluntary motion of the part is suspended or annihilated; but there may possibly be some who are not aware that the inability of the *sentient* nerves of the extremities to convey to the mind the knowledge of the fact that the parts are in existence; or that the muscles are in action; or require to be exerted to remove a part from injury, is attended by the same general result, *viz.*, an inability to move the part, although the nerves of motion are in an unimpaired condition, thereby constituting a *second* form of paralysis. Such, however, is the case, and the disease arising from such a cause, is known under the title of anæsthesia.

In anæsthesia, the affection may be confined to a small portion of the skin; or to the skin of the entire surface of a single finger, or of an entire limb; or it may extend to a great part of the body.

In the disease just noticed, *viz.*, anæsthesia, if it is limited to the extremities, there exists in some cases the singular phenomenon, that the person suffering from it possesses perfect motion of the part *all the time the eye is directed to it*, *i.e.*, while the eye performs the office of a sentient nerve; but the part falls motionless immediately the eye is averted; and the part remains, to all intents and purposes, in the condition of a paralytic limb;—indeed the person knows nothing of its existence except by sight or touch.

A singular instance of this affection fell under my notice about three years back, in a young lady (the sister of one of my pupils), who could perform upon the pianoforte all the time she watched the movements of her right hand, but who no longer retained that power when the eye was averted.[143]

A case of this kind also of recent occurrence, affecting the lower extremities, is narrated by Dr. Brown Séquard, in his Lectures on "Paralysis of the Lower Extremities," 1861, p. 94, which case was under his care at the time he wrote. Dr. B. S. says, "A very interesting symptom —*i.e.*, the loss of the power of guiding the movements of the lower limbs—may be observed in cases of a tumour pressing upon the lower extremity of the spinal cord on its posterior surface. There may be in such cases no real paralysis, or at least all the movements of the various parts of the lower limbs are possible, *so long as the patient can see them;* but when he tries to move these limbs in the dark, or when he does not look at them, he cannot succeed in making the movement he wishes to perform. Besides, he does not know where his feet or legs are, unless he looks at them or touches them with his hands. He may be able to stand on his feet when he sees them; but if he ceases to look at them, he is at once in danger of falling down. This condition depends upon the alteration of some of the posterior roots of nerves, and of the posterior white and gray parts of the spinal cord, producing partial anæsthesia of the skin and muscles of the feet and legs. I have now a case of this kind under my care." Others of older date are reported in the *Cyclop. of Prac. Anat.*, see Note 143.

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[143] In a case reported by Dr. Yellowly, "The patient used to drop glasses, plates, &c., if her attention was directed from them; but so long as she kept her eyes on them, she held them in perfect safety." A second case is related by Mr. A. Cooper. A third by Dr. Ley, in which "there was defective sensibility of one side of the body. The patient could hold her child in the arm of that side, so long as her attention was directed to it; but if surrounding objects withdrew her from the notice of the state of her arm, the flexors gradually relaxed, and the child was in hazard of falling."—*Cyclopædia of Practical Medicine*, 3 vol. p. 242.

It must not, however, be supposed that in *all* cases in which the sentient nerves are impaired that voluntary power is retained in the muscles if the eye is directed to the part, as such is not the fact. In a case under my own care, in the City Orthopædic Hospital, at this time (1861), the child has no feeling whatever in the legs below the middle of the thighs. In this case the muscles are not devoid of the contractile power, for I can excite them to instant contraction, although the child herself has not the least control over them, nor is she capable either of standing or performing the slightest movement,[144] neither when she looks at the limbs, nor when her eye is averted.

At the present moment, I have only drawn your attention to the diastaltic, or spinal system of nerves, the action of which is confined to sensation and motion. I must, however, not omit another system, *viz.*, the peristaltic, known under the title of the nerves of organic life, or the *sympathetic* system, as branches of this system are intimately united with every trunk of a spinal nerve. In several parts of the body this system is distributed to the adjacent organs, far more abundantly than is the case in other parts or organs; and although it is not to the exclusion of the spinal system, yet this latter system is as it were lost in the former; as the former is apparently lost in the spinal in the other parts of the body.

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[144] This child is now (Feb. 1862) walking about.

The action of the sympathetic or peristaltic system of nerves is altogether independent of the will, and in health is performed *without our consciousness;* but in disease, this absence of sensation during their action is departed from, and warning symptoms of danger amounting to pain, varying from the slightest twinge to the most sickening and excruciating agony, are communicated to the brain and to the spinal system, whereby the action of the latter is proportionably heightened, or depressed, according to the diseased action going on in the part.

The parts of the body just alluded to as deriving their nerves almost exclusively from the sympathetic system, are the stomach and intestines, in which parts we are all aware that in health we can scarcely say that we are at all conscious of the action going on within them; and of the few movements with which we are cognizant, the impression is communicated to us through the sensation existing in the neighbouring organs, as, for example, the abdominal muscles, which are in contact internally with the parts in which the motion exists;—but, upon the occurrence of disease, or even the simple distention of a part of the bowel, by a small quantity of flatus arising from an undigested portion of food, how acute is the sensation, and how sickening the effect occasionally produced upon the system generally, in which the abdominal muscles, although in contact with the bowels, participate no more than any other part of the body.

That such is the effect of irritation of the bowels by flatulency, indigestible food, disease, &c., I need only appeal to the individual experience of each of you, as I feel assured that none of you have passed through life without suffering more or less from such a cause.

As such effects unquestionably occur from these causes, I think we may fairly infer that such sources of irritation cannot fail to give rise, in *infants, and children*, in whom errors of diet are proverbial, to effects which act injuriously upon the system at large, and in some instances become the direct exciting cause of the action of the voluntary, or diastaltic system of nerves, in producing the irregular action of the muscles previously described.

It has been long known that certain sources of irritation are capable of producing, through one or the other of the systems just mentioned, either for a time or permanently, excess of action, evidenced by the condition of temporary spasm; of convulsions; or of permanent contractions;—or, on the opposite, of deficient action, varying from a slight weakness in an individual muscle, to a complete loss of power of one or more parts of the body.

The sources of irritation acknowledged to be capable of exciting the effects to which I have just alluded, are numerous; and many of them, as I informed you in the previous Lecture, exist and exert their baneful influence as congenital affections; we therefore need not be surprised at finding we have to resume their consideration at birth, from which moment onward to the period of death no age is exempt from their influence.

The first source of irritation to be noticed, as directly leading to the production of irregular muscular action, is the pressure upon the head of the infant during birth, and I am inclined to consider that some of the cases of deformity recognised at this period, and hence called congenital, may owe their existence to this particular cause.[145]

From the period just named throughout infancy and partly through childhood, there is hardly a condition of the body apart from health, that is not capable of inducing convulsions, varying in intensity from the apparent smile during sleep, to the highest possible degree, leading to paralysis or death, among which conditions we may particularize—the irritation of the retained meconium (a cause acting also doubtless *before birth*); the existence of simple flatulency; the irritation of teething; the existence of worms in the alimentary canal; the incubation of the exanthemata, (especially of the measles, scarlet fever, and the small pox), or the scanty appearance, or the recession of the eruption;—indeed, there is not an acute disease to which the infant, or child, is liable, that is not occasionally productive of the irregular nervous action to which I have alluded, and its attendant convulsion.

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[145] I have recently been consulted in the case of a child with congenital paralysis of the right arm; and the mother's account is, that she had a very bad labour, so that instruments were obliged to be used, which caused the bad arm.

To show the extremely slight causes which are occasionally sufficient to induce convulsions, I may mention that a short time back I was consulted by the friends of a young lady, 21 years of age, in whom the slightest pressure upon the spine, or shake of the bed, would induce a spasmodic condition of the muscles, that lasted for several minutes, during all which time the body was quite rigid.

I cannot refrain at this point from reminding you that *every one* of the *sources* of irritation to the nervous system, that I have as yet named as directly and unquestionably giving rise to convulsions and other dire effects in infancy, is to be found in the category of diseased actions *which have been proved to have existed antecedent to birth*, with the exception of the first, *viz.*, compression of the brain during birth, and this cause may almost be said to belong to both periods;—and, to draw your attention to the fair and direct inference to be deduced therefrom, that the same causes are capable of inducing congenital deformities; and that they give rise to them by the same kind or mode of action, *viz.*, by the propagation of the morbid influence to the brain or spinal cord (or, as spoken of now by *reflex* action), through the nerves distributed to the parts in which the irritation exists, but especially through the sympathetic system, and by the consequent exalted, or diminished action in the motor nerves distributed to the affected parts.

Passing onwards to the consideration of the causes applying solely to this division of the subject, we find the category very materially enlarged; for example: the irritation of the stomach and bowels occasioned by the improper food with which infants are so commonly fed; relaxation or other disease of the bowels; the effect of improper drugs, especially those containing opium, some form or other of which is so constantly found in the hands of nurses, for the avowed purpose of inducing sleep, or of appeasing the temper; the effect of ardent spirits administered for the same purpose, or for the relief of flatulency; the persistence of pain from any cause; the effect of severe and prolonged coughing, as in hooping cough; of croup; the drying up of eruptions; injury to, or disease of the head, as blows, hydrocephalus, &c.

Or, again, passing from childhood through the periods of adolescence, maturity, and even old age,[146] we find in each of those periods the existence of causes capable of giving rise to spasms, or convulsions, or paralysis, and thereby producing deformity; for example: the suppression of perspiration; the drying up of eruptions or healing of sores to the effect of which the constitution had become habituated; mere imitation, as seen so frequently as the cause of squinting; fright; uterine irritation; affections of the urinary organs; injury to, or disease of the membranes, or substance of the brain; or of the membranes, or substance of the spinal cord; or the action of the narcotic poisons, as opium in small repeated doses; or exposure to the fumes of certain of the mineral poisons, as mercury and lead;[147] in fact, any cause which is capable of inducing congestion or inflammation, or merely functional disorder of the brain or spinal marrow.

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[146] I have recently, in consultation with Dr. Shaw, of Battersea, seen a lady, sixty years of age, the subject of Paralysis Agitans, in whom, within the previous two years, a club-foot has resulted from the spasmodic action of the muscles—also a woman, at the City Orthopædic Hospital, with club-foot and contracted hand from puerpural convulsions.

In a former Lecture I stated that if spasm be so transitory as to pass off in a few minutes, or even days, it may do so without inflicting any injury on the muscle that has been so affected, in accordance with the first specified mode of the subsidence of spasm. An excellent example of this is furnished by the following case of a child 2¾ years old:—

Joseph Woodcock, aged 2¾ years, was put to bed apparently in good health. In the morning he awoke crying, and pointed to his feet and hands. Upon examination, the feet and hands were found to be swollen. The toes were drawn down (*i.e.*, flexed at their first joints, but not at the second or third), and any attempt to draw them up (extend them) gave great pain. The hands were also somewhat swollen, and the fingers were drawn together and slightly crossed, and, like the toes, were bent at the first joints. The other joints were fully extended, and any attempt either to extend the finger on the metacarpal bone, or to *flex* the second or third joints, gave great pain. The thumbs were similarly contracted, and drawn across the palms; but these, also, were only flexed at the first joint (see

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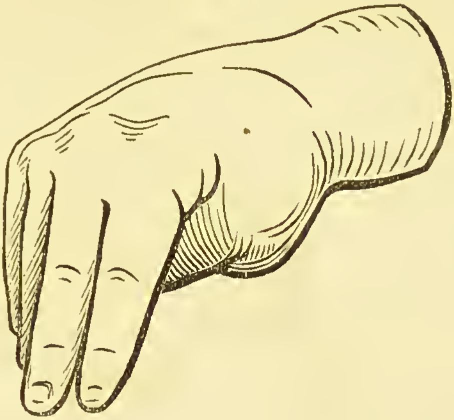
[147] Exposure to the fumes of mercury or lead produces convulsions, tremor, or complete paralysis, by weakening the nervous energy.

Diagram 84). The parts were much hotter than the rest of the body. In three days from its accession, the spasm had entirely subsided, and the child was as well as before the attack.

No. 84.



E. J. C.

84. Copy from my Note Book of a pen-and-ink Sketch of the Right Hand of Joseph Woodcock.

That spasm, when once induced, does not pass off always in this manner, is evidenced by the following most interesting but severe case (see Diagram 85), in which the head is drawn down on the left shoulder by the spasmodic action of the muscles of the neck, especially the sterno mastoid. The peculiarity of the case, and its pertinency to our present subject, is this, that the woman could, by her own effort of will, move her head round; but it was almost instantly spasmodically jerked back again to the position represented in the Diagram, which was drawn from a cast I had taken when I first attended her.

The woman had been thus afflicted for some years, and therefore the case is an excellent example of the persistence of spasm in the muscles of a part for a prolonged period, which muscles, moreover, remained to a certain degree, *i.e.*, for a few moments at a time, under the control of the will. Thus, the head could be voluntarily moved in any direction, as previously stated; or it could be moved by the hand, and retained in any position for a few seconds, whereupon a series of spasmodic jerks commenced, and it required a very great amount of force to resist the powerful and spasmodic efforts of the muscles to draw the head down upon the shoulder.

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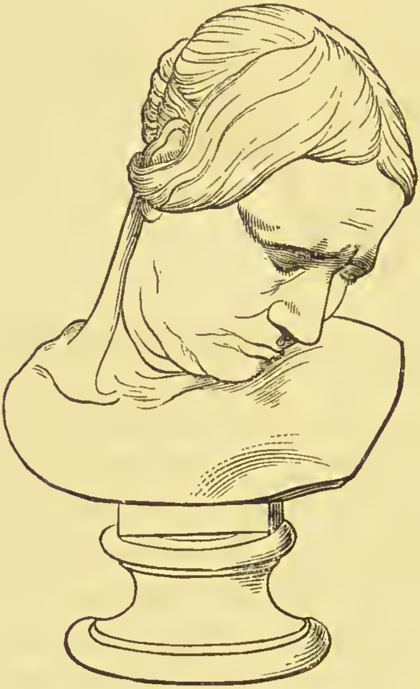

E. J. C.

85. Drawing from a Cast of a Woman suffering from Spasmodic wry Neck.

At the time the foregoing case came under my care, at the City Orthopædic Hospital (1851), I had never before seen such a deformity, and it therefore interested me very much. Since then I have seen several. At the present moment I have two under my care—one at the Hospital, and one in private—both of which are quite as severe as the case now recorded.

As the explanation of the nature of the exciting cause, *viz.*, nervous action, by which the various sources of irritation to which I have alluded, produce their effects upon the nervous system, and from thence are propagated to the muscular tissue, is a matter of pure physiology, it is needless for me, as well as foreign to my purpose, to enter upon its consideration, and I have, therefore, only to refer you to works appropriated to the consideration of such matters.

The proximate cause of acquired deformity, to which I have up to this time drawn your attention, has consisted solely of an error in the contractile power of the muscular fibre, arising from excess, or deficiency of nervous force. I have now, however, to enter upon the consideration of the second kind of cause, *viz.*, disease or injury implicating the tissue of the muscles themselves, or that of the surrounding tissues, whereby changes are induced which prevent them from exercising their proper functions.

The first error of this division to which I shall direct your attention affects the muscular tissue itself; *viz.*, Inflammation. Inflammation may be either of a simple or of a specific character. In either case, its existence for any prolonged period induces changes which impede contractility. The nature of these changes I shall now attempt to elucidate.

The fibres of which a muscle is composed, are bound together, as you are aware, by cellular tissue into little bundles termed fasciculi, several of which are associated together and united again by cellular tissue into a larger parcel; by the repetition of which process, a number of fasciculi are at last bound together by a common envelope and constitute a muscle; the surrounding envelope of cellular tissue being termed its sheath; and the portion around, and between the different fasciculi, and fibres, the "intermuscular cellular tissue."

The first appreciable effect of inflammation in a muscle, as in other structures, is to induce an increased flow of blood to the part, the vessels of which soon acquire an enlarged calibre, and to all appearance are greatly increased in number.

The part of the muscle in which these changes are first apparent is the intermuscular cellular tissue, or the cellular sheath, to which parts it may be confined, if the inflammation be slight:—but if the inflammation be intense, or be prolonged, the depth of colour of the muscular fibre itself becomes heightened from the above named changes taking place in it also, and at the same time it becomes tumified or thickened by the effusion of coagulable lymph, &c., whereby its power of contraction, and capacity for motion, is interfered with to a greater or less extent, varying in proportion to the degree of inflammation, from the slightest obstruction to complete inability.

If the inflammation be transient and terminates in resolution, the whole of these effects gradually recede, and the muscle is left unimpaired in form or function; —but if, on the contrary, the inflammation be intense, or be prolonged, then, in addition to the changes already noticed, the intermuscular cellular tissue becomes infiltrated with fibrinous, or corpuscular lymph, which, according to its character, gives rise, on the one hand, to agglutination of the muscular fasciculi together, or, on the other hand, to their separation from one another by the diffusion of pus.[148]

The best example of the separation of the muscular fasciculi from each other by pus, that has fallen under my observation, I met with in the body of a subject brought to the dissecting room, and, therefore, unfortunately, I can give you no history of the symptoms experienced during life.

In this subject the *psoas magnus* muscle was immensely distended, as if it were the sac of a large abscess, for which, indeed, it was taken by all who observed it previously to my dissecting it out. The fasciculi composing the muscle were widely separated from each other, and the distension of the whole muscle was so great that adhesive inflammation had taken place between the outer side of its sheath and that of the transversalis muscle, and the pus had formed a passage for itself between the transversalis and oblique muscles over the edge of the ilium. Interesting, however, as these points are, the most interesting remains to be told, *viz.*, that the cellular tissue surrounding the anterior crural nerve, as well as that surrounding its branches, was distended with pus down to the point at which the nerve was emerging from the brim of the pelvis, to such a degree that it was at least an inch in diameter.[149]

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[148] I have myself met with one case of abscess in the substance of the heart, the particulars of which, and an account of the post mortem, are given in the *Lancet*, p. 548, vol. i., 1846; I have also referred to one or two other cases, the specimens of which are in existence.

It has been asserted that the occurrence of inflammation in the structure of a muscle permanently destroys the contractility of the inflamed portion altogether, but this assertion I think is erroneous; at all events it requires corroboration. If, however, the *structure* of the muscle is destroyed, whether by inflammation or otherwise, it is never regenerated, but its place is supplied by fibrous, or cellulo-fibrous tissue.

Under ordinary circumstances such are the effects of inflammation upon the muscular structure, and when once induced, none can doubt its power to destroy the perfect action between the antagonist muscles, and in this manner to give rise to the abnormal position of the parts of the skeleton which constitute many deformities.

There is, however, a form of specific inflammation which deeply interests us, from the numerous instances of deformity, and even of decrepitude, which occur from its ravages;—I allude to that form of inflammation which is peculiar to rheumatism.

The chief seat of rheumatic inflammation is unquestionably the fasciæ which surround and protect the muscles and other organs in every part of the body, for which reason the consideration of the errors peculiar to it hardly falls within the present part of our subject; but as the muscles are always implicated directly or indirectly by such inflammation and their movements for a larger or a shorter period interfered with, I consider it better to introduce the matter at this stage of the investigation.

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[149] I have the preparation now, but unfortunately it is not in a condition to exhibit.

In many parts of the body the fasciæ form broad and thick aponeurotic layers, consisting of parallel tendinous fibres, united laterally by others which traverse them in various directions, the whole of which are connected either with the periosteum or are directly continuous with muscular fibres, and therefore perform the office of a tendon—in other parts of the body the fasciæ consist of cellulo-fibrous tissue simply, which directly invests all the organs of the body, and thus constitutes a direct medium of communication between part and part, and in some situations constitute distinct layers which are interposed between the muscles of the region and perform, in a degree commensurate with their comparative strength, the same kind of office as the more dense and tendinous aponeurotic fasciæ.

Of the first, or the aponeurotic fasciæ, the best instances are the lumbar fascia, and the fascia lata;—the first of which, as you are aware, consists of an expanded, *i.e.*, aponeurotic, tendons of several muscles, the fibres of which tendons are intimately blended the one with the other so as to constitute but a single membraniform layer that passes backwards to be attached to the apices of the spinous processes of the Lumbar Vertebræ;—and the second is a dense theca or sheath enveloping the muscles of the thigh, from the inner surface of which sheath processes pass off to be attached to the periosteum of the shaft of the femur. These processes isolate the muscles from each other, so that each muscle and its tendon is retained in its own partition, and the sheath, and processes together is rendered more or less tense, in given directions, as necessity requires, by the action of powerful muscles which are directly inserted into it.

Of the second kind, or the cellulo-fibrous fasciæ, the best instances are the cervical fascia; and the layer which is interposed between the aponeurotic fascia of a part and the skin, and hence named the superficial fascia. The first of which fasciæ, *viz.*, the cervical, resembles the fascia lata in the mode in which it envelops the muscles of the region, and in the processes which it sends inwards between each of the muscles. The second, or superficial fascia, consists of a condensed layer of cellular tissue, in which but few fibres are intermingled, and in the substance of which tissue the adipose cells are deposited, and the cutaneous or superficial vessels and nerves ramify.

The fasciæ, therefore, vary in structure from the purely fibrous, in which many of the fibres are direct continuations of the muscular tissue, and in every respect both as regards structure and use, tendinous fibres, and pass down through a series of gradations, to the simple condensation of the cellular tissue, intermingled with a few fibres;—or even lower still to the simply condensed cellular tissue alone. The transition from the fibrous to the cellular tissue is in many instances so gradual, that it is difficult to say where one ends and the other begins; and we even find the very same fascia in one individual distinctly and decidedly fibrous, which in another individual is purely cellular, without the admixture of so much as a single fibre; but this is not at all to be wondered at, when we reflect that in both tissues the ultimate fibre is made up of filaments which agree in every respect with each other;—in all probability are identical;—and that the apparent difference of the tissues simply depends upon the aggregation of a greater or lesser number of fibres in a given space; the glistening aspect peculiar to tendinous fibres being only an acquired property, as it is known to be absent in the early stages of development.

It is stated by many of our best authorities that muscular fibre is seldom, if ever, affected by rheumatic inflammation; but this point is nearly immaterial to our enquiry, as the cellular sheath which surrounds the muscle, and the intermuscular cellular tissue which surrounds the fasciculi, if not even the sarcolemma or tunic of the elementary fibre itself, may undoubtedly become affected either primarily or secondarily. That such should be the case, we can readily comprehend, if we bear in mind that in every region of the body the muscles are surrounded by fasciæ of one or the other description; and that, as I have just pointed out to you, the most dense fibrous fascia passes by insensible degrees into the simple condensed cellular tissue which surrounds and enters into the substance of the muscle. The occurrence of inflammation, therefore, in such tissue is simply the propagation of the same kind of inflammation from the surrounding fascial covering into an adjoining portion of the same kind of tissue.

The changes produced in the muscles by rheumatic inflammation correspond with those previously described as the result of simple inflammation, with THIS EXCEPTION, that it (Rheumatic Inflammation) *is seldom, if ever*, followed by the formation of PUS, *or by the occur-*

rence of Gangrene, the explanation of which may probably depend upon the exemption of the muscular fibre from becoming the seat of this peculiar inflammation; or upon the less degree of intensity of the inflammation itself. The changes consist, therefore, of effusions of fibrinous lymph into the areolæ of the cellular tissue of the part affected, whether that be the intermuscular cellular tissue;—the cellular envelope;—or the enclosing portion of the fascia;—of the agglutination of contiguous parts together;—*of the deposition of a gelatinous glairy fluid into the sheaths, surrounding the tendons*;[150] and ultimately of a change of structure in the muscular fibre itself; and of a loss of nervous power approaching to paralysis;—the category, therefore, is sufficiently formidable to account for all the numerous and severe cases we daily see resulting from this cause.

The most distressing and severe case of Rheumatic Deformity that I ever witnessed was, doubtless, the poor man, William Brittain, whose hands I have depicted in Diagram 31. He came under my notice in 1850. His history was as follows:—

He was 41 years of age. Ten years before I saw him he was an out-patient of the ——— Hospital for Syphilitic Rheumatism. He had not been able to walk for seven years. He had not fed himself for five years. When I examined him he could neither bend his hip, knee, ankle, or toes; nor his shoulder, elbow, wrist, or fingers. He could scarcely bend his head, and only half open his mouth. He could not bend his back at all. His fingers were all bent as depicted in Diagram 31, and his toes were similarly deformed. He thought himself that his fingers and toes were bent from trying to push himself up in bed. His finger-nails grew away from his fingers, and some of them were half an inch thick. His general position was that of a person lying on his back, with his head a little bent on the body, so that it required to be supported by a pillow; his arms down by his sides, a little bent at the elbows; his legs semiflexed at the hips and knees; his feet at right angles with his legs. His own remark respecting the cause of his deplorable condition (*Syphilitic* Rheumatism) was worthy of recording. It was as follows:—"I see a great many going the same way as me; but they wont think, nor mind me when I tell them, although they see me."

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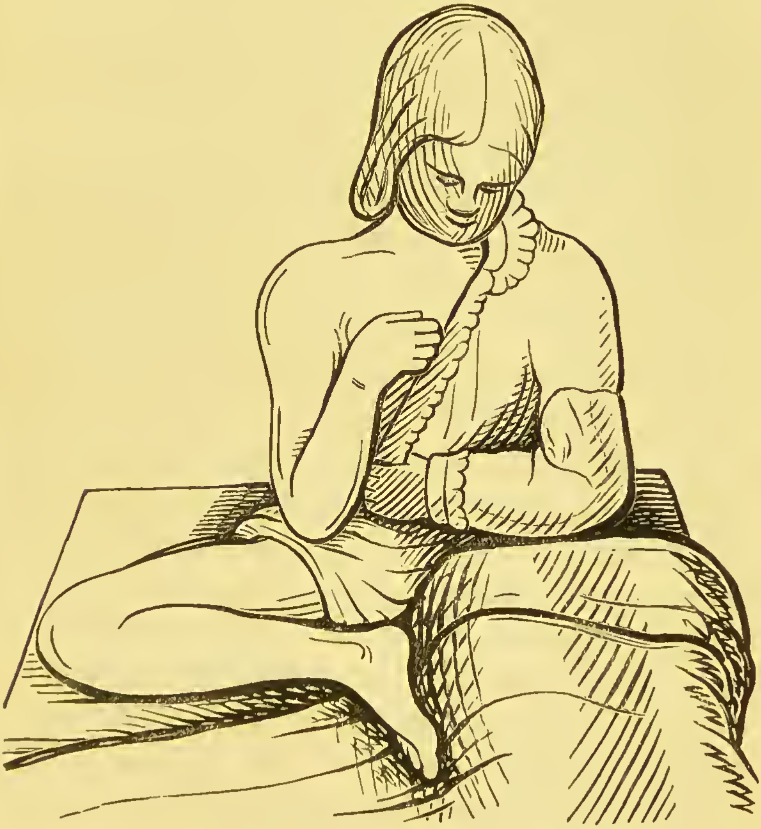
[150] This is sometimes enormous. In a case that I had the opportunity of examining through the kindness of Dr. J. Rayner, of Kingsland, the sheaths surrounding the tendons of the extensor muscles on the back of the hands and wrists were so much distended that the parts were covered with lumps, and at least twice their normal size.

Within the last year, however, I have had a most severe and interesting case under my care, as an in-patient in the City Orthopædic Hospital. In this case, (Zipporah Isaacs, aged 14), the deformity was entirely the result of acute Rheumatism, of which disease the girl had had several attacks. In one of these attacks, in 1860, she had been for twelve weeks an in-patient of the ——— Hospital. When she left the Hospital, her right leg was already drawn so much up, that she could only touch the ground with her toe. The contraction of the muscles of the leg continued to increase until the right thigh was drawn up and *abducted* to a right angle with the body. The leg was fully flexed on the thigh, so that the calf was in contact with the back of the middle of the thigh, and the heel touched the nates. The foot was fully extended (Talipes Equinus).

The position assumed by this limb was one that I had never before seen; nor can it normally be so placed. It could only have been acquired by gradual contraction of the muscles, aided by force of some kind. In this case, I think the force must have been the weight of the bed-cloths superadded to the weight of the limb itself. As she reposed on her back, these two forces would be constantly acting on the hip joint, and abnormally rotating the head of the femur. From this position the slightest attempt to remove the leg gave great agony. After the leg had fully acquired the degree of deformity above narrated for at least three months, she had another attack of Rheumatism, and then the right arm began to be painful at the wrist and elbow, to relieve which it was retained in a bent position (as the leg, doubtless, had been before); and, as a consequence, the arm and hand became fixed in a fully contracted position. Thus the upper-arm was drawn close to the side; the fore-arm fully flexed; the wrist flexed on the fore-arm; and the fingers so firmly flexed that the nails had made sores on the palm. The only movements she could make with any part of these limbs were slight flexion and extension of the toes; and a barely perceptible movement of the thumb, which rested on the closed fore-finger.

So firmly was the arm contracted against the side, that it was with the utmost difficulty and pain that a portion of her linen dress could be got between them. The opposing surfaces of the skin in the poplitcal space, and in the axilla, as also at the bend of the elbow, were excoriated. In the popliteal space (which it will be remembered had existed much the longest period in a contracted position), the surfaces of the skin were beginning to be adherent from granulations, and I was obliged to tear them apart before I could introduce even a single piece of lint. An idea of her position in bed may be obtained from Diagram 86, which is a copy of a

No. 86.



86. Copy of pen-and-ink Sketch of Zipporah Isaacs as she appeared sitting in bed on her admission to the City Orthopædic Hospital in May, 1861. The Leg and Arm retained exactly the same position when she was lying down.

pen-and-ink sketch made in my Note Book on her admission.[151]

An alteration in the structure of muscular fibre, and attendant loss of power, similar to that I have just alluded to as one of the sequelæ of Rheumatic Inflammation, is in many instances the simple result of prolonged disuse, for which reason I have considered it right to place it, *viz.*, prolonged disuse, in my list as the third cause capable of inducing change of structure in the muscle, and thereby causing deformity.

Whenever a joint is retained at rest in a given position for a prolonged period of time, no matter what the cause be which induces it to be so retained, whether it be disease within the joint itself, whereby the great pain attendant upon the motion of its inflamed surfaces imperatively impels the muscles of the part to remain in an absolutely quiescent state;—or Rheumatism affecting the parts around it, the agonizing pain of which is increased by motion;—or external wounds requiring absolute and prolonged rest for their treatment;—or simple mechanical interference;—or, indeed, any possible cause of absolute and prolonged rest;—changes gradually take place in the intimate structure of the muscles acting upon that joint; flexors as well as extensors; adductors and abductors; in the muscles most extended, as well as those most contracted. These changes equally impair the contractility of the muscles on the one hand; and the property of elongation

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[151] This case, although apparently so hopeless, nevertheless, yielded entirely to treatment; and the girl left the City Orthopædic Hospital in January last, with the arm and leg as free from contraction, and as perfect in their functions, as the limbs of the opposite side.

(whether considered spontaneous or not) on the other; so that at last, if the rest be sufficiently prolonged, the muscles of the part are totally incompetent to perform their functions from absolute disorganisation.

The first appreciable effect of disuse on the muscular tissue, is a diminution of the quantity of blood which is sent to the part. It is both less in quantity, and contains a smaller quantity of red globules, from which it results that the muscles begin to lose their colour, and become much paler than in other parts of the body. This first condition is therefore exactly the reverse of that which occurs in inflammation, for, according to Mr. Paget's experiments and opinion, as stated in his Lectures at the Royal College of Surgeons, the first appreciable effect of inflammation is an increased flow of blood to the part; which is soon followed by an increase in the size of the vessels themselves; and by a great accession to the number of red globules ordinarily existing in that fluid, so that in severe cases the vessels become filled by the red globules to such a degree that the current of blood through the vessels is altogether arrested, and the colour of the part heightened to the well-known hue of inflammation.

As a perpetual change is taking place in the atoms of which every part is composed, by the absorption of the old, and deposition of new ones in their place; and as the red globules of the blood are the parts of that fluid out of which those new molecules are formed, and their number during health and exercise, we may assume, is accurately proportioned to the absolute want of the part; it follows, that as the red globules out of which the new atoms are to be formed, are as stated above, diminished in number, and the current of blood itself less in quantity, that the atoms which are removed from the muscles by the ceaseless action of the absorbents, cannot be replaced to the same extent, or with the same integrity of form and function, as when the conditions of the circulation in the muscle is natural; and therefore, that loss of substance and of functional power will result, to a degree proportionate to the length of time the defective nutrition exists. In this deduction we shall find ourselves borne out by the absolute condition in which the muscles are found in such cases, for we find them first to become sensibly less firm to the touch, and gradually to diminish in size, and to lose their power of contraction and of elongation, until at last the muscular fibre is converted into a yellowish tissue, which, although it retains the fasciculated appearance of the muscle, the change is nevertheless so great, that it is ordinarily spoken of as the conversion of muscle into fat.[152]

A most instructive example of deformity induced entirely by the long retention of a part in a fixed position during the treatment of another part, is, unfortunately, frequently seen as the result of the bandaging the hand with the fingers extended on the splint, used in the treatment of fracture of the arm.

I have seen many such cases, and some of them so severe as to defy all subsequent treatment. In one case, a poor man who quite recently applied to me, the fingers and thumb were fully extended and quite immoveable;—even the rugæ marking the situation of the knuckles, both on the back and front of the fingers, were quite obliterated. The case was quite hopeless.

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[152] In a case of severe incurvation of many years duration, narrated by Dr. Costello (the Editor of the Cyclopædia of Practical Surgery) at the Westminster Medical Society, the muscles of the back were quite white.

A second, and equally instructive case, had been, and is, at the present time, under the care of Dr. Taylor, of Bethel Place, Camberwell. In January last I was called in, in consultation with that gentleman, and I am therefore reporting the case from my own knowledge of the facts. In this severe, but deeply interesting case, the tendency to the production of deformity from this cause is well marked, and most clearly demonstrates how keenly our attention should always be on the alert to prevent injury to the limbs, whenever prolonged rest in a constrained position is imperative in the treatment of a given injury, or disease.

The case was one of severe illness that had confined E. W., aged 30, to his bed about a month. When I first saw him he was suffering from the most deep and extensive suppuration, and destruction of the parts in the perineum, that I had ever beheld; and superadded to this there were large bed sores. One bed sore extended entirely over the sacrum; and in a few days the suppuration from the destroyed cellular tissue between the skin and lumbar fascia, occupied the whole space from the floating ribs down to the trochanter major on each side. So severe and extensive was this suppuration that the entire skin of the loins on both sides of the spine, was detached, and constituted the external walls of two immense diffuse abscesses, which were separated only by the spinous processes, the apices of which remained adherent to the skin. To afford a hope for recovery from this immense destruction of parts, recourse was had to the prone position to remove the pressure from the back; and free incisions were made in the loins on each side, as well as over the trochanters, to permit of the escape of the pus. The inflamed condition of the fascia lumborum (which was exposed to view by the upper incisions), and in all probability the extension of that inflammation to the erector spinæ muscles beneath, rendered every movement of the back, or head, intensely agonizing; indeed, his head could not be moved from the pillow; and the slightest touch even of the finger on the back would cause the gentleman to scream and tremble with agony. The prostration and emaciation were also so extreme, that during a period of nearly three weeks after I saw him, the attention required to maintain life, and to avoid giving pain, overweighed every other consideration.

At length, however, the strength began to improve; the pulse became less frequent (from 140 to 130; and 130 to 120), and the pain in the back less severe; but as the improvement in his general condition became greater, it soon became manifest that the constrained position of his arms, which during all this time he had retained by his side as the only possible easy position, had told most injuriously upon them. At first this inability to move the arms was supposed to be only a disinclination to do so on his own part in order to avoid giving himself pain in his back; but it was soon discovered (within three weeks) that it was from a *positive inability*, from absolute contraction of the muscles and parts around the articulations of the shoulders and elbows, whereby the slightest attempt at extension gave pain so intense, that it could not at that time be employed. As the wrist and fingers could be freely moved while the arms reposed by the side, those parts are free from contraction The neck is so stiff that it is with difficulty and pain that the head can be turned from one side to the other in the requisite daily movements. The legs, I have no doubt, are in the same condition. I know the leg cannot be fully flexed upon the thigh, and the opportunity for the mere attempt at flexion of the thigh on the body has not yet been afforded, as the wounds in the perineum, and on the back do not even yet permit of the attempt. That they are so, I am convinced, but no attempt can be made at present to remedy it, inasmuch as he cannot, even now, be placed in any other position than on his face, nor can he even move himself on the couch. That he will ultimately regain the use of his arms and legs I have no doubt, provided *he will continue to submit to the pain* that follows every attempt at the forcible extension, which is ordered to be practised. Had this condition not been watched for, and detected; or, had we listened to his supplications for us to desist from our attempts to move his head, arms, and legs each day;—or had he positively refused to submit to the pain that is unavoidably inflicted by so doing—he would have been as stiff in the arms, legs, and neck as the poor man (W. Brittain), whose case is mentioned (p. 242), as the result of rheumatic inflammation.

In the majority of cases of this description, contraction may be avoided, provided the attention is on the alert to the fact that deformity does result from the retention of a part too long in a constrained position.

In the present case no amount of care, nor watching could have prevented it, because an alteration of his position was impossible. Throughout all my surgical experience, I have never seen such extensive suppuration; nor any disease or injury of the back, so severe as this affection of the erector spinæ muscles; or any one so thoroughly helpless for so long a time. It is now upwards of two months that this gentleman has been totally unable to assist himself in the least. To make the slightest change in his bed, or linen, requires three persons, *viz.*: two to lift him, while the third performs the required change. For a month he could not move, nor alter his position in any way from that in which we left him—not even so much as to move his head on the pillow; consequently it has required the utmost attention to prevent bed sores on the *chest* and behind the *ears*. I mention these particulars to demonstrate the fact, that in *this* case it was an absolute impossibility to prevent the limbs from being thus long retained motionless.

The extraordinary rapidity with which contraction of so severe and firm a character has supervened demands our most serious attention. It may possibly admit of several explanations, but that which appears to me the most satisfactory, is one that is in strict accordance with the views I have promulgated in pages 247 and 248, respecting the changes which take place in muscles from disuse.

I have already mentioned in the case of E. W., that when we first placed him in the prone position, the emaciation and prostration had already reached that extreme point in which our whole attention was demanded, and devoted, to the sustaining of life. It was during such emaciation and prostration that the first effects of prolonged rest in one position, was brought to bear on the neck, arms, and legs; and by the time (between a fortnight and three weeks) our anxiety to save life was relieved by a slight but positive improvement in his general health, contraction of his neck and arms had already proceeded to a considerable extent. It will thus be seen that the injurious effect of prolonged rest, in this instance, was brought to bear on the muscles of the neck, arms, and legs at the precise time when they were emaciated to the utmost possible extent, and the least capable of resisting injury; consequently, as improvement in health and strength began to advance, each increment of newly-formed matter that was added to every fibre of each muscle so retained at rest, was secreted or deposited to fill the place of an atom *already deteriorated* in function; and, moreover, the newly-developed atom itself was absolutely prevented from having its own nascent functions of contraction and elongation exercised beyond a very limited extent. The newly-deposited fibre was, therefore, subjected to influences that were injurious to its power of contraction and elongation (and especially the latter) from its first development. As this gentleman has latterly rapidly regained flesh, each contracted muscle has been redeveloped under the most unfavourable circumstances. In the first place, each increment of new matter was added to a muscle already impaired in its functional power;—and, in the next, it was added to a muscle in a condition of absolute rest, from the period of extreme debility and emaciation up to its acquiring its almost original bulk. That the foregoing is the explanation of the severity of the contraction in this case I have little doubt, for it has been remarked that from time to time as he regained strength in other respects, so, in proportion, the contraction of his arms, &c., was found to be more and more rigid.

The next error to which I am desirous of drawing your attention, consists of direct injury implicating the muscular and adjoining tissues, such as wounds; or bruises leading to open wounds; especially those which involve, either originally, or by the subsequent sloughing, an absolute loss of the muscular tissue; for this tissue, as I previously told you, is *never* regenerated; and therefore the void left by the injury has to be filled up by fibrous, or cellulo-fibrous tissue, which, after the manner of a cicatrix, gradually contracts, until the ends of the divided muscular fibres are brought nearly into contact, and the muscle is thereby proportionably shortened, and deformity the inevitable result.

Wounds or bruises, however, not involving loss of substance in muscular tissue, may equally lead to the production of deformity, by the inflammation necessary for the repair of the injury giving rise to adhesion between the sheaths of the muscles and the contiguous parts, and thereby creating an absolute impediment to motion; consequently, the position in which the joint has been retained during the treatment will be permanent, unless subsequent treatment can *effect the re-absorption of the adhesive matter*, which, in many cases, as I can testify, can be brought about.

In the neighbourhood of the joints the tendons of the various muscles are closely bound down in their respective sheaths to the articulation around which they pass, by a dense fascia. In these situations the occurrence of wounds or bruises, if sufficiently severe to give rise to much inflammation—especially if that inflammation be accompanied by suppuration—is almost invariably followed by deformity. If we confine our observation to those cases in which the surgeon succeeds in healing the wound, the joint is nearly always left more or less motionless, according to the extent of the injury, degree of inflammation, and extent of suppuration induced. In such instances the deformity is the result of the adhesion of the tendons to their sheaths; of the sheaths to the fasciæ; and indeed, of all contiguous parts to each other, by the coagulable lymph that had been poured out during the healing process.[153]

The only other cause of deformity directly implicating the structure of muscle in common with the surrounding tissues, that remains to be considered, is the occurrence of abscess either in the substance of a muscle, or in the immediate vicinity of muscles or of their tendons.

The term abscess, strictly speaking, implies a collection of purulent matter circumscribed by an indurated portion of the surrounding cellular tissue, constituting what is called its sac, or cyst; but collections of pus occur, around which no such sac or cyst exists, and in these instances the abscess is termed diffuse,[154] *i.e.*, the pus is diffused to a greater or less extent into the cellular tissue of the part.

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[153] Cases of deformity of this description are of constant occurrence, and have doubtless fallen frequently under every Surgeon's notice.

[154] In one case under my care (Mrs. Roberts's), there was a diffuse abscess on one side from the scapula to the loins, from caries of the Cervical Vertebræ.

Of the first kind, or encysted abscess, we rarely find it located in the substance of a muscle,[155] as the muscular fibre appears to be nearly exempt from the suppurative action; but the diffusion of pus throughout its entire substance, or diffuse abscess, *i.e.* in the cellular tissue situated *between its bundles of fibres*, may occur in it like any other part, and an instance of this kind I have already brought under your notice in the case of the psoas muscle, p. 237.

Of the two forms of abscess, the latter, or the diffuse abscess, is far more prone to occasion deformity than the former, and this is more especially the case when it is situated in the neighbourhood of the palms of the hands, or the soles of the feet, in which situations it is frequently found as the result of apparently trivial punctures, whitlows, &c. In these parts the matter when once formed has to overcome in its passage to the surface such great resistance from the dense fascia and skin which bind it down, while its passage upwards by the sides of, or within the sheaths of the tendons, is so comparatively unobstructed, that destruction or agglutination of the parts, and resulting deformity, is the inevitable consequence, if efficient and early treatment be not employed to prevent it.

The presence of enlargements in the neighbourhood of the joints, whether resulting from abscess, tumours, &c., will of course impede motion by their presence simply, and hence constitute deformity; but these cases, at this early period, constitute matters of general surgery, and their consideration is not included here.[156]

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[155] See Note 148, of a case of abscess of the heart.

The fourth class of causes capable of producing deformity are those which offer mechanical impediment to the action of the muscles, while the muscles themselves are in a state of integrity. These causes present themselves in the form of contractions of the adjoining textures, *viz.*, of the skin, the fasciæ, or of the ligaments.

Contractions of the skin, or the first of the errors named, is of frequent occurrence, and the displacement of parts consequent thereupon is so great, that deformity of the most severe kind is often the result.

In health the skin is soft, pliable, distensable, and elastic. By the union of these properties, it adapts itself readily to the form of the part it covers, which, as you are aware, varies with every action of the muscles, or alteration in the position of the limb.

The connecting medium between the skin and enclosed parts is the cellular tissue, or, as it is usually termed, the superficial fascia, the chief office of which is to form a bed in which the superficial vessels and nerves may ramify in their course to the skin, and by its great distensibility, or rather the freedom with which it can be moved in every direction, to permit of the gliding movements which exist between the skin and the parts beneath.

The amount of cellular tissue interposed between the skin and subsequent parts, varies in different regions. In some places, for example, over the abdomen, there appears to be hardly any limit to its quantity, or to the fat which is deposited in it. In other parts, as for example, on the top of the head, it is entirely absent, and the skin cannot be separated from the muscle beneath. In other situations, as for instance, the palms of the hands and the soles of the feet, although it is present, there is a limit placed to its development, and its thread-like fibres which surround the little globular masses of fat which are always found in these regions, retain a distinctly fibrous and indistensible character; moreover, these fibres are continuous beneath with the dense palmar, or plantar fascia, and superficially they are united with the skin. This peculiarity of the cellular tissue in these parts is one requiring especial notice, as we shall hereafter see, when we are considering the deformities of the hands.

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[156] I have this day (August 12, 1850) punctured with a grooved needle a tumour in the popliteal space, which impeded motion and free extension; the contents of which, consisting of a glairy jelly-like fluid, passed off by the side of the needle, and entirely removed the obstruction.

The skin, in common with the other parts of the body, is liable to disease and injury. From either of these causes, the vitality of a part may be destroyed; in which case it is absolutely necessary, ere reparation of the injury can take place, for the injured portion of *skin to be removed* by the process of sloughing. In the case of *direct violence*, portions may be entirely removed at the time of the accident.

When a portion of the skin has been removed either by sloughing or violence, the denuded surface of the subjacent cellular tissue becomes covered with granulations, and ultimately with a new material or skin, which at first possesses, to a certain degree, the common characters of the old skin; but, *in addition to those* *characters*, it also possesses one of a totally opposite nature, *viz.*, a power of contractility.

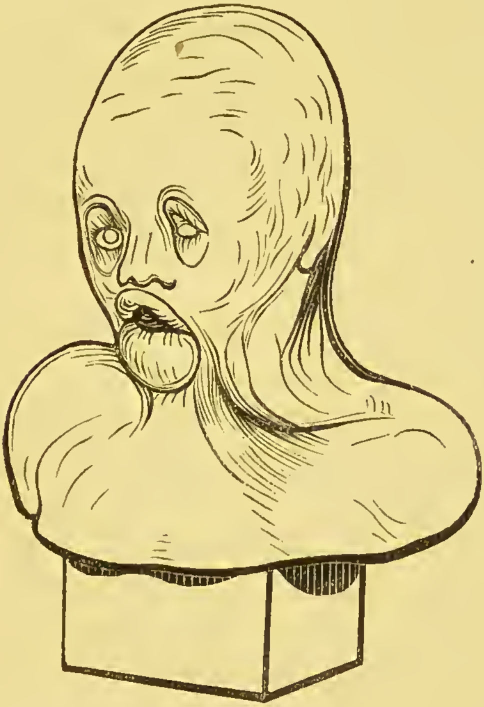
The *property of contraction* possessed by the newly-formed covering of the wound is a most important provision of nature to redress the injury that had been inflicted, as it gradually drags the surrounding surfaces of the skin nearer and nearer to each other. If the wound was small, the edges of the skin will be drawn into actual contact, and only a white line, or seam, will be left to indicate the seat of the injury. In this case the new material is entirely re-absorbed, except the small quantity which unites the edges of the skin together. This power of contraction (valuable as it unquestionably is in the majority of instances), becomes nevertheless in others the direct cause of frightful deformity, from the surprising force which it exerts upon the surrounding parts: for example, whenever a large portion of the skin is destroyed, especially if the injury is in the neighbourhood of a joint, the new-formed material, or cicatrix, as it is termed, which even at the beginning is never so large as the portion of destroyed skin (in consequence of the contraction of the granulations, round the edges of the wound during cicatrisation, diminishing the exposed surface), gradually but powerfully begins to exert this peculiar property, and the adjoining skin is forcibly drawn down, until the limit of its own distensibility is reached, whereupon it begins to constitute an opposing force, and both it and the unyielding cicatrix are drawn together into ridge-like bands.

As the contraction proceeds uninterruptedly, unless it encounters some absolutely irresistible opposing, natural or artificial, force, the ridge-like bands become from week to week both thicker and shorter; and acquire, more and more, *a fibro-cartilaginous character*, until they feel as if the tendon of a muscle was enclosed within each of them; or as if they consisted of a mass of brawn. The force exercised by such contraction upon the surrounding parts becomes progressively greater and greater, and at length gives rise to contractions of the joints in every possible degree within the limit of the natural motion of the part. In many instances it exercises sufficient power to draw parts into positions which in the healthy skeleton *they cannot possibly* occupy (see Diagrams 33, 34, 35, 36, and 37). In other cases it absolutely causes a change in the form of one or more parts of the skeleton itself.

The kind of injury from which these ridge-like bands are the most frequently produced, are severe burns, and scalds, the cicatrices from which, in most instances, even at the first moment of their existence, are so many elevations above the surrounding skin, in which character they differ from those arising from other causes.

The deformities produced by these causes, *viz.*, burns and scalds, are numerous, and surpass in severity those produced by any other cause that I am acquainted with. For example, look at this cast of a case of frightful deformity from this cause (see Diagram 87). In such cases affecting the neck and chest, the result is not merely the drawing down of the head by the cicatrices, but also the positive retention of the mouth and eyes in an open position; and in more severe cases still, to such a change in the form of the bone of the lower jaw, that the teeth project horizontally forwards, instead of occupying their natural perpendicular position; I cannot also refrain from again drawing your attention to the casts now

No. 87.



E. J. C.

87. Outline Drawing from the Cast of a Person severely Burnt about the Face and Neck. Both Eyes were destroyed. The Eyelids were inverted and drawn widely open. The Mouth was retained open, and the Under Lip was inverted and drawn down to the lowest point of the Chin by the thick and dense Bands of Cicatrices passing from the Chest on each side. The Head was also bowed forwards by the same cause.

upon the table (see Diagrams 33, 34, 35, 36, and 37). In this deformity (see Diagram 33) you observe the foot is abducted and drawn upward to such a degree that the outside of the foot and the little toe are intimately united to the outside of the leg, in such a position that it would be absolutely impossible for you to place the foot by any degree of force you could exercise; and in Diagram 37, the hand had been equally severely contracted by the same cause, so that the inner edge of the palm and little finger were drawn up and joined to the inside of the arm.

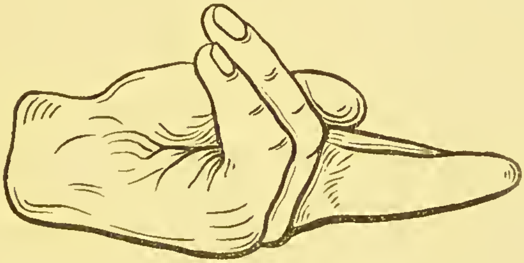
The skin, however, is liable to become contracted, although no portion whatever of its substance has been either destroyed or removed, *i.e.*, it may become affected by disease, which has the power to induce thickening and contraction of its own substance, or of the skin in conjunction with the subjacent tissues; in either of these cases it induces deformity.

In some of these cases the contractions are evidently the result of inflammation of a low or chronic character, resulting from irritation of that particular surface; while in others the contraction appears to arise spontaneously, *i.e.*, without manifest cause, but in all these latter instances I am much inclined to believe that the same cause has existed in them which gave rise to the deformity in the former, namely, low inflammation, and that it has escaped observation from the trifling amount of uneasiness which it occasioned.

The affection to which I have just alluded is known under the term Hypertrophy, or excess of nutrition. It manifests itself in these parts, *viz.*, the skin and the subjacent cellular tissue and fascia, by giving rise to thickened ridges which are destitute of the elasticity and distensibility of the skin, and in some cases are as hard and fibrous, or even fibro-cartilaginous in their nature, as those which result from burns or scalds; in fact, with the exception that these bands retain their normal colour and cuticular covering, and in some cases present a nodulated appearance, as if they contained a series of little tumours, they in all other respects and properties resemble cicatrices.

The parts of the body most frequently deformed by this cause are the palms of the hands, and the palmar surfaces of the fingers, in which situations the contractions are so dense that it is difficult to make yourself believe the flexor tendons are not included within them,[157] and the deformity produced varies in degree from the slightest impediment to the free extension of one of the joints of a finger to the total inability to extend the 2nd and 3rd phalanges of two or more fingers (see Diagram 88). In some cases the points of the fingers are thereby retained close to the palm.

No. 88.



E. J. C.

88. Outline drawing from the cast of the Left Hand of a Man with a contraction of the Fourth and Fifth Fingers from Hypertrophy of the Skin.

The most severe instances I have ever seen of deformity resulting from hypertrophy of the skin have occurred within the last two years. In one of these, a child about three years old, it commenced without manifest cause, in the right thigh, just over the saphenous opening of the fascia lata, and gradually passed in a direct line downwards in the tract of the long saphenous vein, across the thigh to the inner edge of the popliteal space, and thence down to the inner ankle. It presented the appearance of an elevated band of a brawny hardness, slightly discoloured of a yellowish hue, and here and there enlarged into nodules. It was about an inch wide at the top, and gradually tapered off until it was lost in the ankle. Pressure caused pain; but not severe. As soon as the hypertrophy had extended beyond the knee, that joint began to be contracted. When I first saw the child the foot was elevated three inches from the ground, and he could only walk with a crutch. In the second case, the hypertrophy was located in the upper arm. It was exactly of the same character as the former, and was beginning to cause contraction of the elbow. In both these cases the skin, in conjunction with the subjacent cellular tissue, was affected by *thickening* and *contraction* without manifest cause. In my own opinion, it was in some way induced by the lymphatics of the part, the course of which it accurately followed in both cases. If such was the case, the inflammation was of too low a character to induce suppuration, or create any symptoms of general fever. As these are the only two instances of this affection that have fallen under my notice, or that of my medical friends, I have thought it right to bring them thus prominently forward.

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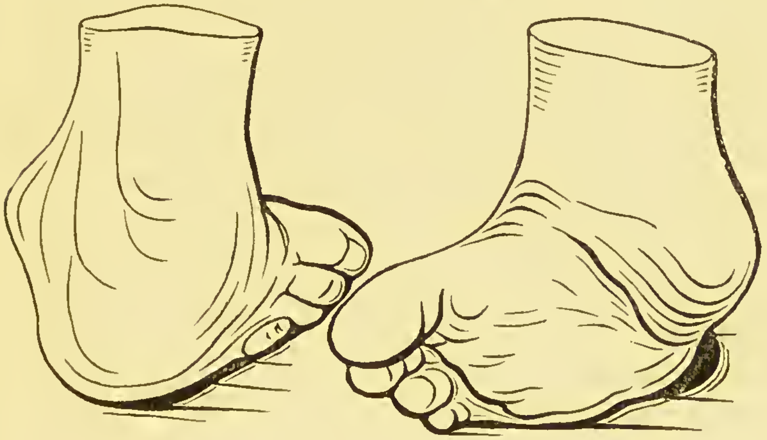
[157] "At first sight, the flexor tendons seem to be the cause of the distortion (Scrivener's spasm); but the dissections of Dr. Goyrand and others have shown that the cellular tissue, between the skin and palmar aponeurosis usually gives rise to it. Dupuytrein asserted, that the fascia itself was the chief cause."—*Fergusson's Surgery*, p. 203.

The contractions of the fasciæ and of the ligaments which constitute the second and third causes named in this division, may with propriety, be considered together, inasmuch as the fasciæ and ligaments are anatomically alike in their intimate structure; are affected in a similar manner by diseased action; and in several parts of the body are directly associated in producing the same effect upon the skeleton; *viz.*, in limiting the extent of motion between the parts united together by them; or, in affording direct support.

Of the existence of a contracted condition of the fasciæ, or of one or more of the ligaments of a part, and of deformities produced thereby, we have ample proof. The instances are numerous, and affect various parts of the body; for example: in the fasciæ and ligaments of the hands, as especially seen after rheumatism (see Diag. 31,

No. 89. No. 90.



89. View of the Outer Ankle and dorsum of the Right Foot of a Child with Talipes Equino Varus, to show the manner in which the tarsus is bent upon itself inwards.

90. View of the Inner Ankle and plantar surface of the Sole of the Foot of the same Child, to show, 1stly, how completely the Foot is adducted and doubled upon itself; 2ndly, to exhibit the deformed state of the Toes, which is also dependent on contraction of the ligaments and fasciæ around the heads of the metatarsal bones and first phalanges; and, 3rdly, the deep crease in the Sole of the Foot from the rigid contraction of the plantar fascia.

of Rheumatic Hands);—in the fasciæ and ligaments of the foot, as seen in many cases of club-foot (see Diag. 89 and 90);—or in the same parts around the knee, ankle, or other joints;—in all of which situations they are frequently found contracted to a great extent, and to present one of the chief obstacles to be overcome by the remedial treatment.

The causes capable of inducing a contracted condition of the fasciæ and ligaments are of two kinds, *viz.*, inflammation and interstitial absorption.

That inflammation may affect the fasciæ and ligaments as well as other parts of the body there can be no doubt; and one form of that affection, *viz.*, "the rheumatic," as I have already told you, is peculiar in being almost limited in its action to the fibrous tissues, among the chief of which are the fasciæ and ligaments.

Inflammation, therefore, affecting the fasciæ or ligaments, may be either common or specific; it may arise spontaneously; be transmitted to them from the surrounding parts; or result from an injury; and when once produced, unless it be speedily subdued, it gives rise to depositions of lymph between their fibres, to thickening of their substance, and to dimunition of their elasticity and flexability. In some instances to ulceration and suppuration, but these latter effects appear to result only in those cases in which the parts are subjected to pressure from confined purulent matter resulting from inflammation of other parts, as for example, the synovial membrane within the joint &c.

In the animal economy, the fasciæ and ligaments fulfil the office of binding parts together; of limiting the extent of motion between them; and frequently, of affording direct mechanical resistance to opposing forces which are constantly tending to remove the articulating surfaces of the bones from one another; for example, the plantar fasciæ and ligaments perform all these offices, as they not only bind the bones of the foot together, and limit their motion, but they also, during progression, support the constant pressure of the whole weight of the body, and thereby relieve the muscles from an immense expenditure of power.

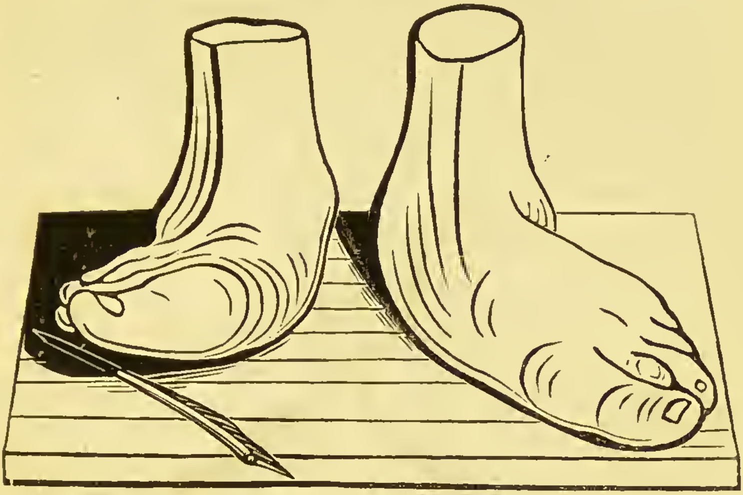
Of all the parts of the body, however, the knee stands forth pre-eminently as the joint in which the fasciæ and ligaments perform the functions above named, to the greatest extent and perfection. In this joint, although it is more exposed than any other, and required constantly to resist a vast amount of mechanical force tending to displacement—*viz.*, the weight of the body—the articulating surfaces are apparently but ill adapted for the production of steadiness or of strength, as the examination of the skeleton will convince you. Notwithstanding these unfavourable conditions of the bones themselves, how firmly are the condyles of the femur bound to the adjacent surfaces of the head of the tibia, by the crucial and lateral ligaments, and by the middle and expanded part of the tendon of the semi-membranous muscle (which here may be viewed somewhat as a fascia), the direct action of which parts is to prohibit flexion, either laterally or anteriorly, while the arrangement and action of the crucial ligaments prevents the flattened surfaces of the tibia from slipping off the rounded condyles of the femur, and at the same time affords an effectual and additional obstacle to the rotation of the bones upon one another.

From the nature of the office performed by the fasciæ and ligaments, *the natural stimulus to their growth and repair* consists of a certain amount of *absolute tension upon their fibres*, the *absence* of which would act as injuriously upon their texture, as the absence of the stimulus of contraction does upon that of the muscles, *i.e.*, it would cause their *degeneration*, by the interstitial absorption of their component atoms; and as such is the case, we may be prepared to meet with contraction of these parts wherever the conditions of the surrounding parts have been such as to maintain a joint in a position which has absolutely relaxed the healthy tension upon the fibres, and thereby deprived them of their natural stimulus. If we consider this process a little further, we shall perceive that it is in itself a beautiful provision of nature to counteract or repair injury, for by it, the *superfluous* length of the ligaments and fasciæ is gradually removed, until at last they are restored to such dimensions that they can again *exercise their proper functions.*

In many cases of deformity, the contraction of the fasciæ and ligaments are therefore *secondary*, *i.e.*, they are the pure result of the *absorption* of their fibres *from retention* in a *relaxed position* by a previously existing cause of deformity.

The fasciæ and ligaments of a part are, however, occasionally found in the exactly opposite condition to that we have just been examining; or in which, instead of being contracted, they are preternaturally elongated, and fail to afford the normal support, in consequence of which the articulating surfaces of the bones of the part are permitted to be separated, more or less, from one another, and deformity is the invariable result, as in splayfoot (see Diagrams 91 and 92); or in the

Nos. 91 and 92.



91 and 92. Outline drawing of the casts of the Feet of a Man severely afflicted with Talipes Valgus. The drawing represents the Feet as they appeared when the Man stood up, in which case the front of the Right Foot was raised from the ground at least three inches. The Sole of the Left Foot touches the ground its whole length.

examples of abnormal flexion of the leg forwards, as seen in Diagrams 28 and 29; but in these instances the fasciæ and ligaments must be regarded more in the light of permissive, rather than as active agents, in the *production of deformity*, inasmuch as the limb can be perfectly restored by a slight force to its proper position.

The office of the faciæ and ligaments, in the greater number of parts of the body is, as I have previously told you, to bind parts together;—to afford direct mechanical resistance to opposing forces; and to relieve the muscles from an useless expenditure of power. In the performance of this office, the fasciæ and ligaments require that the muscles should strictly and accurately perform their duty, inasmuch as if, from any circumstances, some of the muscles fail to perform their part, an amount of force, injurious both in degree and in *direction*, is permitted to be exercised upon the fasciæ and ligaments, under the influence of which they yield, and become elongated by an effort of growth (for they are indistensible), induced by the abnormal stimulus ; on the other hand, the ligaments[158] on the opposite side of the joint, are as injuriously acted upon by the *removal* from them of the *necessary and natural stimulus of the normal tension upon their fibres*, the effect of which, as previously seen, is *absorption*. From these conjoined and simultaneous actions, therefore, there results a condition of the limb, in which the fasciæ and ligaments on the one side are *longer* than they ought to be, while on the *other side* of the same joint they are *preternaturally shortened*, hence deformity is the natural

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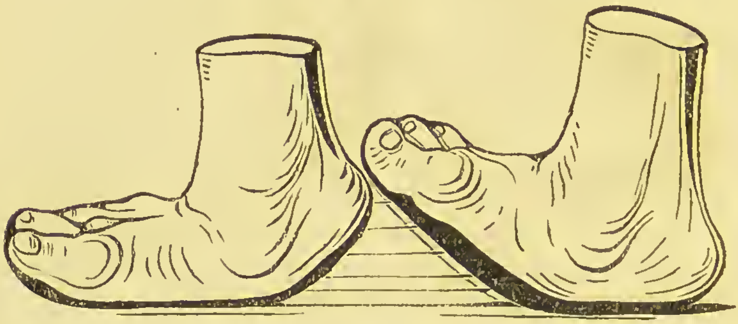

93. A Side View of the Right Foot of the Man represented in Diagram 91 standing on the front part of the Foot, or Toes and Metatarsus.
94. A Side View of the same Foot standing on the hind part of the Foot, or Heel and Tarsus. In progression he placed the Heel down first, and then rolled the Foot on to the Metatarsus and Toes. The two Diagrams represent the beginning and end of a step.

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[158] Long confinement in bed is said to give rise to the softening of the ligaments.

result. Such a condition of the limbs is found to exist in each of the cases 89, 90, 91, 92, 93, and 94; as also in many cases of knock-knees (see Diagrams 15, 30, and 95), in all of which cases, on one side of the joint, the ligaments, &c., are abnormally short, or contracted; while, on the other side, they are abnormally relaxed. All these cases are, therefore, in reality cases in which the two latter causes in my table are combined in the production of the deformity;—indeed, a contracted condition of any ligament can hardly occur without a corresponding relaxation or stretching of its natural opponent on the opposite side of the joint.

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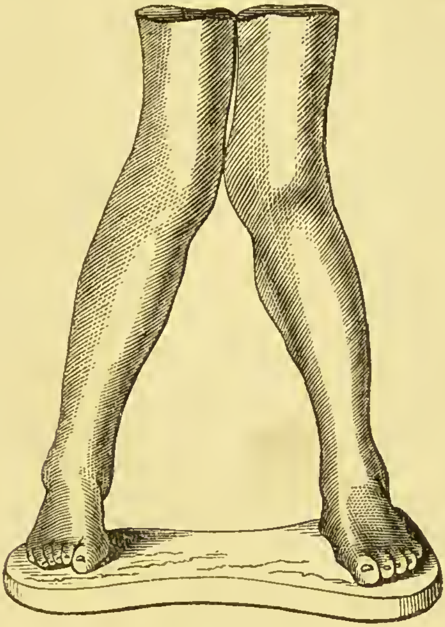

E. J. C.

95. Drawing from a Cast of the Legs of a Man deformed by Knock-knees.

As I have now entered fully into each of the Causes of

Deformity specified in the table (page 44), the present part of my subject is, therefore, brought to a conclusion. In the next Lecture, I shall enter into the consideration of the peculiarities of each variety of Deformity, in connexion with its appropriate treatment, both surgical and mechanical.

APPENDIX

TO

PART I.

ADDITIONS TO INTRODUCTION.

In page xxii. I have alluded to the public protest of Sir B. Brodie and others against Special Hospitals. As it is just possible that some persons may imagine that I have evaded the principle arguments adduced by that gentleman, I now reprint the protest itself verbatim from the *Medical Times* of Dec. 8, 1860, in order that my readers may judge for themselves.

"SPECIAL HOSPITALS."

"We, the undersigned, are of opinion that much detriment to the public and to the medical profession arises from the modern practice of opening small Institutions, under the name of Hospitals, for particular forms of disease, *in the treatment of which no other management, appliance, or attention is required* than is already supplied in the existing General Hospitals.

"The practice is injurious, first, because in the maintenance of numerous small establishments the funds designed for the direct relief of the sick poor are wasted in the useless multiplication of expensive buildings, salaries, and Hospital appliances, and in the custom of constantly advertising to attract public attention.

"Secondly, because the public is led to believe that particular classes of disease can be more successfully treated in the small Special Institutions than in the General Hospitals—an assumption directly contrary to evidence; the fact being, that the resources of the General Hospitals are in every respect superior to those of the Special Institutions alluded to.

"Thirdly, because it is essential for the interest of the public, with a view to the efficient education of students preparing themselves for the practice of the medical profession, that all forms of disease should, as far as possible, be collected in the General Hospitals to which medical schools are attached.

"As an example that the evil referred to is increasing, we regret to observe that an attempt is being made to set on foot a Special Hospital for the treatment of Stone and Diseases of the Urinary Organs. We desire to express our opinion that such an Institution is especially unnecessary; the existing General Hospitals provide ample accommodation for the treatment of all these maladies; *no case is ever refused admission into them;* there are no diseases which receive more care, attention, and skilful management; and there are no men in this or any other country who have greater experience in treating them than the Surgeons of our General Hospitals."

(Signed) Sir B. C. Brodie, Bart., and others.*

That such a glaringly selfish protest should have ever been put forth to the world under the sanction of Sir B. Brodie's name is a matter of surprize and regret to all who respect him. I have already quoted, and replied to, the chief reason assigned, *viz.*, the second. The first reason excites a smile. It is so simple—so feeling for the poor—so disinterested! especially when taken in connexion with the fact, that our large endowed Hospitals are reported to be so rich that they hardly know how to spend their money, and therefore stand in no need whatever of public aid. To the third reason I unhesitatingly reply, on the part of the Orthopædic Specialty, that the Special Hospitals for Club-foot and Disease of the Spine were called into existence by the fact, that the larger Hospitals, *even now*, either do not admit such cases into their Wards at all, or only in such a limited number that it is in no way proportionate to the needs of the poor, or of the Medical Student, as every Medical man is well aware; and in addition to this, if the cases were admitted, the Institutions possess no Special Medical Officers to attend to them. To ensure success, an amount of *personal* attendance on the part of the Surgeon is required in *each case*, that cannot possibly be given by the Surgeon to a General Hospital; consequently, if they were admitted, the only alternative would be to hand such cases over to the pupils. Quite right too, replies both the Surgeon and the pupil; but not so the poor cripple.

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* For the remainder of the signatures, see *Medical Times*, Dec. 8 1860.

ADDITIONS TO LECTURE II.

In page 52, Note 24, it is stated that "in snakes the ova . . . . are hatched by the warmth of the season," &c. At the time that Lecture was printed

(September, 1861), it was generally believed that no reptile whatever [168] hatched its own eggs; but on the 13th of January following, an announcement was made that the large female Python sebæ, or Guinea Rock Snake of West Africa, in the Zoological Gardens, Regent's Park, had laid upwards of 100 eggs, around which she had folded herself in coils, thereby undertaking the duty of hatching the eggs she had deposited (see Diagram 96). On the fifteenth day after incubation had commenced, one of the eggs was removed from her, and a living fœtal snake five inches long was found within it, thereby removing all doubt as to their having been properly fecundated. The snake continued to perform the duty of hatching her own eggs from the 13th of January to Friday last (April 4th, 1862), when the eggs were all removed, as they were known to have become putrid. Since their removal, another egg has been opened, and a fœtal snake nine inches long was found

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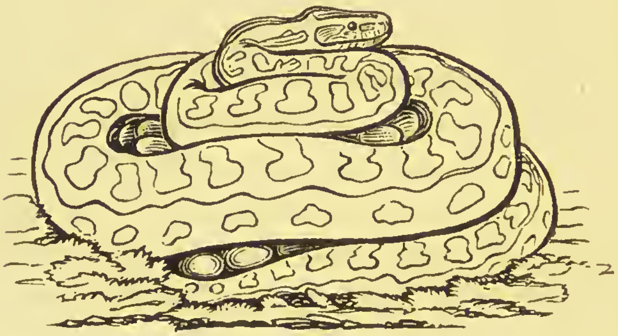

E. J. C.

96. Outline Copy of the Drawing of the Python incubating, given in the *Illustrated London News*, Feb. 8, 1862.

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[168] "Aucun reptile ne couve ses œufs."—*Le Règne Animal*, par M. Le Baron Cuvier. Tom. i., p. 361. Bruxelles, 1836.

within it. This snake had all its proper markings; but it is worthy of record, that in this fœtus, as also in the one removed from the egg on the 15th day, the head in each was *not* in a line with the body, but set on at a right angle like the head of a bird. In the fœtus of the 15th day especially, the head closely resembles the head of the ostrich. They are both in the Museum of the Gardens, at which place I examined them by the kind permission of Mr. Bartlett, the Superintendent. Is this peculiarity of the head a deformity? or, is it the normal phase of development of the fœtus of this reptile at this period?

For a period of five months before depositing the eggs, as well as during all the time she has laid coiled round them (together thirty-two weeks), she has not touched food. I saw this immense python myself on Sunday last (6th April) with a friend, who is a Fellow of the Society (G. Bond, Esq.), and I also saw one of the eggs. It was about three inches long, and its covering was a dirty yellowish leathery substance. We were also much astonished to see the immense reptile lazily gape or rather yawn, thereby affording a full view of the interior of its capacious mouth, with its tongue at its base contracted to a thick lump, about an inch and a half long by an inch wide—at least I presume it was the tongue, for I saw no other. The sight was most interesting, but to me it was afterwards sickening, and induced a shudder to think that, but for that slight partition of plate glass, another moment might have placed those yawning jaws around my head, for they were sufficiently large to have grasped the greatest part of it with perfect ease. The interior of the mouth was of a light pink colour, which contrasted strangely with the striped and scaly external skin. I cannot refrain from expressing my surprize that, apart from the mental knowledge of the power of this creature, there was nothing whatever disagreeable or to cause fear from the appearance of this reptile's immense mouth. I saw neither teeth, nor opening in the fauces, nor eye, nor expression of terror of any kind. Indeed, the nearest thing to which I can compare the appearance of its open mouth is an immense pink flower with only two petals.

As this is the first record of a hitherto unknown fact in natural history, the value of the following particulars referring to it (most kindly furnished me by the gentlemen by whom they were made, *viz.*, Messrs. Negretti and Zambra) will readily plead a sufficient excuse for their introduction in this work. The experiments were made for the express purpose of ascertaining the difference of temperature between the two snakes, one incubating, the other not. Mr. Negretti's observations are as follows:—

"In order to enable us to take observations with greater accuracy, directions were given to the keepers to place the male and female python precisely under the same circumstances, *viz.*, that each should have the same amount of gravel and moss to lie on, and the same weight of blanket to cover them. This being done, we found that the restlessness of the reptile precluded us from using the regular thermometer, which, on an average, take from 30 to 40 seconds to attain the right temperature. We, consequently, made thermometers which in their actions may be called instantaneous, not more than three or four seconds of time being required to obtain correct indications. With these thermometers the temperature of the den, the water, and the moss bed of both male and female was then taken and found to be as near as possible identical. The temperature of the male was then taken, both on the surface of the body and between the coils. The mean temperature of three experiments on each was found to be respectively—

On the surface of the body	71·2 degrees;
Between the coils	74·3 degrees.

The temperature of the male was taken inside the den with the reptile; the female having become very restless, it was thought prudent not to remain inside,[159] but to take the temperature by reaching in the den. This plan was adopted, and the mean temperature obtained was—

On the surface of the body	77·4 degrees;
Between the coils	86·7 degrees;

On a subsequent occasion, the difference of temperature between the male and the female was 20 degrees. This was just as the female was about shedding her skin; but from the fact that it was on that occasion only that such a difference of temperature was observed, there is no doubt whatever that the great difference is to be clearly attributed to the feverish state the reptile was in, consequent upon her changing the skin. From the foregoing experiment it will be seen, that the mean excess of temperature of the female over the male was—

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[159] I have just been informed that Mr. Negretti had a very narrow escape; for, on his leaving the den, the reptile sprung out after him a distance that was estimated by the bystanders at least three feet. Fortunately she missed her grasp.

On the surface of the body	6·2 degrees;
Between the coils..................	12·0 degrees

during the time she was incubating."

That these eggs were not hatched, admits, I think, of a perfectly satisfactory explanation, *viz.*, in the first place, from the repeated disturbances of temperature that must have followed her constant examinations by visitors; and secondly, from the fact, that when shedding her skin, and the temperature the highest, one night she forsook her eggs, and remained from them *in a pool of water* for twenty-four hours, thereby reducing her own temperature greatly, as well as allowing the temperature of the eggs to be so much altered that their vitality was destroyed.

DOUBLE EGGS.

In the Second Lecture (p. 65), I have referred to the extraordinary position in which the fœtus was found in each of the cases, Nos. 137 and 138, *viz.*, in the *body* of the *male* ; and I have also ventured to suggest an explanation of such an occurrence. In the course of those observations, I alluded to the preparations of double eggs in the Museum of the Royal College of Surgeons, and especially drew attention to the cases in which an egg with a perfect shell was contained within an egg (see Diagram 51, p. 69).

Since that Lecture was printed, I have become acquainted with a recent example of a fowl laying a *series* of double eggs. The account is furnished by an old friend of my own, and it was transmitted to another friend, *viz.*, Dr. R. Barnes, who, knowing the subject I was engaged in, most kindly placed the letter in my hands. It runs as follows :—

"NEWCASTLE EMLYN, FEBRUARY 1, 1862.

"MY DEAR ROBERT,—

"What do you think of the accompanying? Perhaps you may find something in it to interest you. I have never met with anything of the kind before.

"A farmer here of the name of Morgan has a pullet which commenced laying some six weeks since, and has laid pretty regularly an egg each day since. Now and then, at various intervals, she lays these double eggs (up to the present time she has laid nine) all alike in every respect, even to the colour of the shells—the inside shell being always of a red tint like the Cochin fowl's, and the partridge's—the outer shell always a dull chalky white, without any gloss or polish upon it. The pullet is evidently a half-bred between a Cochin and a Dorking; but is it not curious that the eggs should always bear the distinguishing marks so plainly—the Cochin egg being always inside the Dorking egg? The two yolks in one egg is common enough; but I never before met with a case like this of two perfect eggs, one contained within the other; and that it must be a very rare, if not a solitary instance, is proved by the fact of the great attention it has excited amongst the farmers of this neighbourhood, none of whom have ever met with the like before, although they have dwelt all their lives amongst poultry.

"I have made a drawing of this egg for my neighbour, which is to go to the 'Illustrated News,' I believe; but I thought perhaps you would like to hear about it: so I send you the rough copy of it (see Diagram 97).

"Should you like to have an egg? Perhaps, if she lays any more, I may be able to get you one.[160]

"Tell me, when you can find time, what you think of the egg.

"Good night.

"Yours affectionately,

"FRANK. H. HORA."

The above explicit account and diagram (see Diagram 97) of the contents of these double eggs is most valuable, as the preparations in the Museum of the Royal College of Surgeons merely demonstrate that an egg with a perfect shell is sometimes found within another. Of the contents of these eggs the College Catalogue is silent. In the cases furnished by Mr. Hora we are distinctly informed that each egg possessed its own proper parts, *viz.*, its yolk, albumen, and shell.[161]

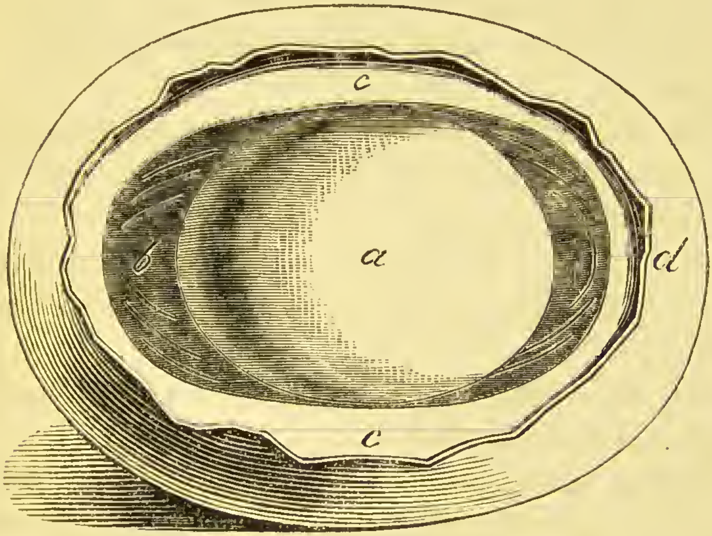
---

[160] Since this letter has been in type, Dr. Barnes has received an egg from Mr. Hora. This egg, like the egg described by Mr. Hora, and represented in Diagram 97, was of an enormous size. It consisted of an outer dull white shell, containing, in addition to its own albumen and yolk, a second egg as large as that of an ordinary pullet. The inner egg was of a reddish brown colour, like the ordinary Cochin fowl's egg, and apparently in every respect a perfect egg. In this instance the inner egg was situated at one end of the larger egg, instead of being in the middle as in Diagram 97.

[161] The shell of the inner egg, in each instance, was like that of the Cochin breed. The pullet was a half-bred Cochin. It is to be regretted, that Mr. Hora did not ascertain and record the kind of fowl

Moreover, that the fowl had laid a series of nine, "all alike in every respect." Since that time she has laid a tenth, which I have seen, as it was sent up to Dr. Barnes as promised in the letter. This tenth egg corresponded in every respect with Mr. Hora's description of the others, excepting that the innermost egg was situated at one end of the interior of the other, with the yolk of the outer egg at its large end.

No. 97.



E. J. C.

97. Copy of Mr. Hora's Sketch of a Double Egg.
a, Inner Egg. A perfect Egg in every respect; hard Shell of a reddish tint, like that of the Partridge; with the White and Yolk perfect; size of an ordinary Pullet's Egg.
b, The Yolk of the Outer Egg, situated at the base or thicker end of the Egg. The Inner Egg rests upon, or is imbedded in, the Yolk to half its depth.
c, White of Outer Egg, enveloping both its own Yolk and also the Inner Egg.
d, Shell of Outer Egg, always of a dirty chalky appearance.

Length of Outer Egg ...	3 inches.
Breadth ditto ...	2¼ inches.
Total Weight	4¾ ounces.

---

by which the hen was trod. The situation of the Cochin or coloured egg, always on the inside of the other, may probably hereafter help to throw some light on the difficult question of the influence of the different sexes on the subsequent progeny.

In my own judgment, these proofs of abnormity in the ovum are most valuable, and throw great light on the production of such cases of monstrosity as Thomas Lane and John Hare; if not also on double monsters generally.

The hypotheses mentioned by Vrolik,[162] that have been assigned to account for double monsters, are as follows:—

1st. The double monster has been supposed to have proceeded from two distinct embryos, which have become united in the course of development.

2nd. It has been held to have originated in a single germ, which has become double, or has been subdivided.

3rd. The germ has been regarded as abnormally composed from the first.

Neither of the foregoing hypotheses, however, affords the least explanation of the occurrence of such facts as the existence of a *female* fœtus in the body of a *male*, who was fifteen years old; or of a male fœtus in the body of a male child ten months old; whereas, in my own opinion, those cases, admit of an intelligible explanation if taken in connexion with these unquestionably perfect[163] double eggs described by Mr. Hora, and figured in Diagram 97.

In pages 49 and 52, I have pointed out that the chief difference which exists between the ovum of the bird, and of the human being, consists in the fact, that in the ovum of the bird it is essentially necessary for a sufficient supply of concentrated pabulum (the yolk and albumen) to be stored up for the nourishment of the fœtal bird throughout its development, and likewise to possess a hard protective case. Its size is, therefore, in proportion to these exigencies. In the human being, on the other hand, the ovum possesses no hard covering, and no more yolk and albumen than is sufficient to nourish the embryo for a brief period, *viz.*, until the outer membrane of the ovum becomes attached to some part of the mother,[164] from which a fresh supply is indirectly obtained by imbition.

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[162] "Cyclop. of Anat. and Phys." vol. iv. p. 973.

From these considerations with respect to the great differences between the ovum of the bird and that of the human ovum, it will be apparent that in the case of a double human ovum the reception of the diminutive innermost ovum with its limited amount of pabulum and delicate chorion, within the substance of the outer, and containing ovum, in which development had already commenced, is not so incomprehensible a thing as the first thought suggests;—moreover, the experiments of Mr. Newport on the number of spermatozoa requisite to fecundate the ovum (see Note 46), throws a little more light on the subject, inasmuch as, if such is the case, it is quite evident that the germ of the external ovum could not fail to receive a greater number of spermatozoa than could probably arrive at the germ of the ovum enclosed within it; and, therefore, that development would be in one of these ova far in advance of the other, thereby affording the conditions necessary for the above explanation respecting the reception of one within the other.

---

[163] Each egg possessed its shell, albumen, and yolk.

[164] It need not be the uterus. Extra-uterine fœtation establishes this beyond a doubt.

That the innermost or contained ovum in the double egg of the bird could not be received into the interior of the frame of the embryo developed from the yolk, &c., of the outer egg is palpable, because, in the first place, there would exist the calcareous shell of the contained egg representing an extraneous substance of many thousand times the size of the embryo, even after development had far progressed; and in the next place, the bulk of the entire quantity of pabulum or yolk would alone equal in size the fully-developed fœtal chick into which it was to be received. For these reasons it is palpable, that such a monstrosity as the development of *a female* in the body of *the male* could not occur in the *bird;* whereas, in the human being, the deminutive size of the entire ovum,[165] and the delicacy of the chorion, permits of our readily comprehending that such might occur easily, and thereby it affords us a rational mode of explaining two of the most unaccountable, staggering, and hitherto unexplained cases ever recorded.

In speaking of double monsters, Vrolik (Ency. of Anat. and Phys., vol. iv., p. 973) says, "A last general rule is that in double monsters the twins are of the same sex. There is no well-proved exception to this rule." Assuming this assertion to be correct, it follows that the case of Thomas Lane, in whose abdomen there was found a female fœtus, is not to be viewed as that of a double monster; and hence it requires a different hypothesis to any that have been as yet mentioned by Vrolick, to account for the presence of a female fœtus in such a situation. Will the foregoing supply this explanation?

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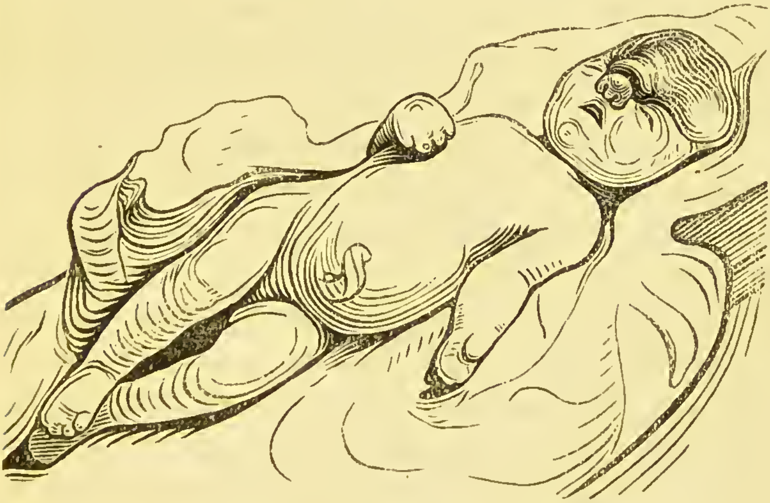
[165] It is too small to be discerned by the naked eye. See Note 62.

ADDITION TO LECTURE III.

In Lecture IV. I brought forward a case of enormous liquor amnii that was accompanied by monstrosity. In this case the monstrosity was believed to be the result of a fright; and the appearance of the child was stated to correspond exactly with the appearance of the mutilated cat, by which the fright, or rather disgust, had been occasioned (see p. 164). In this respect it was a case of the most pertinent kind to Lecture III., on the reputed influence that mental emotion during pregnancy exerts in causing deformity; but I was compelled to leave the consideration of this subject at that time, as it was irrelevant to the subject then under consideration. I will, therefore, resume it now, by drawing attention to Diagram 98, which is a faithfully-traced outline draw-

No. 98



98. Outline tracing of a Photograph of the Monstrous Fœtus described by Dr. Barnes, page 165.

ing of the photograph mentioned in Lecture IV., and by stating that it is a recent and well-authenticated account of the singular *coincidence* of fright and deformity, mentioned a month before delivery, by a lady in whose case there is the *most certain physiological proof* that the *fœtus was monstrous* at least four months before the time when the fright was received.

The case is undoubtedly one of considerable interest, as there is satisfactory proof that a fright was received, and *mentioned* before delivery, as well as a *belief* that the child would be deformed. On these points there can be no doubt, but the question of interest to us is to determine whether it was a pure coincidence, or whether the occurrence of fright and deformity in this case stood in the relation of cause and effect, as reported in the narrative of the case.

The facts themselves, however, *as regards dates*, so carefully narrated by Dr. Barnes, furnish ample testimony in refutation of the idea that there could be any such relation between them. Thus, the shock, or "vivid mental impression," was not received until "the fourteenth of August," at which time the fœtus was *six* calendar months and a fortnight[166] old (*seven* lunar months), at which time a normal fœtus is not only FULLY developed, but in some rare cases even *viable*. That it is *fully* dedeveloped, see Diagram 76 from Hunter's plates; but every Member of the Profession is well aware of this fact.

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[166] Dr. Hassall, in a note to Dr. Barnes says, "The mother is now before me; she says she was delivered at seven months and a fortnight, and the cat was brought in when six months and a fortnight, reckoning from quickening."

In this case, therefore,[167] *if* the fœtus was, *as assumed*, perfectly formed up to the time of the fright, *viz.*, six and a half months, not only had parts *to be absorbed* in a most extraordinary and mysterious manner, for example, the upper part of the head, so that "there was the mesial fissure down to the brain; and there was the right eye depressed from its natural position, and hanging down upon the cheek,"[168]—but in other parts of the body (for example, the hands and feet), portions had *to be added;* thus, "the skin of the hands extended down, binding the phalanges of the fingers together, covering part even of the nails, so as to leave only the tips exposed." That all this change should be effected in a fœtus *twenty-eight weeks old* in the short space of *one* month (the fright was received on the 14th of August, and she was confined on the 14th of September following), is to suppose a rapidity of absorption in one part, and of development in another that is most startling,—and, moreover, it is to suppose that which there are no known facts to support. On the contrary, an examination of the preparations of acephalous monsters (see cases 160 to 167 inclusive, p. 63), in the Museum of the Royal College of Surgeons, will furnish counterparts of the deformed or monstrous head;[169] and Mr. Streeter's account (p. 168) of the fœtus, from which Diagram 80 was drawn, will throw considerable light on the *early origin* and *real cause* of the deformity of *the head;* and lead by inference to the date of the commencement of the deformity in the hands and feet, both of which are in perfect accordance with the character of the deformity seen in many other cases. For example, Diagram 52 exhibits the fingers webbed down to the nails;—and Diagrams 99 and 100 is an example of a case in which the hands were even far more like claws[170] than the hands of Mrs. Moody's child; inasmuch as, by Dr. Hassall's own account, *the fingers existed*, and were covered by the skin, "so as to leave only

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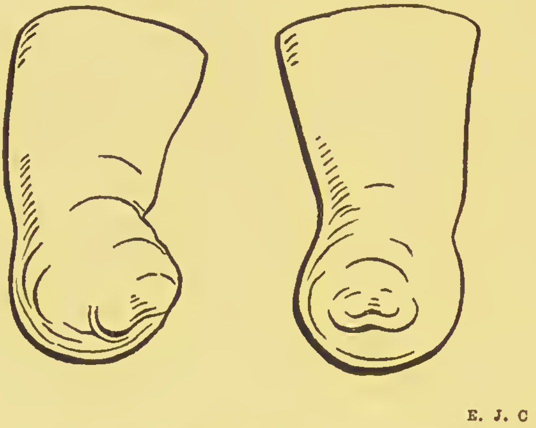
[167] The nature of the deformity of the head demonstrates to a certainty that it had been a monster long before the time of the fright.

[168] The photograph does not bear out those remarks (see Diag. 98) as the skull is not split down to the brain, nor is the right eye depressed from its natural position and hanging down on the cheek. It is, indeed, most fortunate that this photograph was taken. Without it the case would have been considered irrefutable.

[169] It is especially deserving of notice, that in *each* of the foregoing

No. 99. No. 100.



99, The right, and 100, the left, Hand of a Child born without Fingers or Toes. In each Hand the Carpus was perfect. The metacarpus imperfect, and abnormally developed. The phalanges of the Fingers and Thumb absent except the extreme phalanges of the first and second Fingers, which existed as a nodule on which there was a nail. Diagram 9 is drawn from one of the Feet of the same Child.

---

cases of superabundant liquor amnii the fœtus was *acephalous* and deformed in the *hands* and *feet;* and in each case the mother *doubted* whether she was really pregnant.

[170] Compare Diagrams 98, 99, and 100.

the tips exposed:" while in the case from which Diags. 99 and 100 were drawn (which case was brought to me at the City Orthopædic Hospital when the child was only five weeks old, and I myself took the casts of the hands and feet, from which the Diagrams were drawn), the fingers were entirely absent, with the exception of two nodules on each hand, each of which was terminated with a nail. Each hand, therefore, represented a roundish paw-like clump, as seen in the Diagram;—moreover, the feet of this child were totally deficient of toes. Diag. 9, p. 16, is drawn from one of them, and it is the exact counterpart of the foot of Mrs. Moody's fœtus (see Diagrams 9 and 98).

There are, however, two other points in which the case of Mrs. Moody is valuable. First, it is an admirable example of the demand made on the imagination to recognise the existing deformities as an actual resemblance of the object that occasioned the fright; or the article longed for. Thus, the indentation between the protuberances on the left side of the really abnormally *enlarged* cerebral portion of the head, leading down to the inner canthus of the left eye, is *imagined* to be like the " split skull in the mesian line, making a V-shaped opening down to the brain ;"—and a little tumefaction about the eyes (for both are alike tumefied) is fancied to be like the mangled eye of the cat, which, it is stated, was forced " down upon the cheek." That the skull is not " split in the mesial line, making a V-shaped opening down to the brain," and that the eye is not depressed from its natural position and lying down on the cheek, is evident from the diagram, which I again repeat is a most faithfully-traced outline of the photograph, which in its turn cannot err. Both these assertions are, therefore, pure stretches of the fancy.

The description of the resemblance of the hands and feet to a cat's paws is equally unfelicitous and ingeniously imaginative; for example, the feet are *really perfect*, with the exception that the toes are webbed;—and the hands are not both deformed alike. The right hand has certainly been very well arranged by the photographic artist to resemble a cat's paw; but the photograph is sufficiently distinct to show the knuckles, fingers, and thumb, as also the flexure of the wrist and outline of the hand, both of which are nearly normal. The left hand is much more deformed, and has the appearance of a partially deformed hand with a very large thumb in a thick mitten. It is so unlike a cat's paw that it certainly does require an extraordinary amount of inventive imagination to liken the one to the other, and of willingness to be deluded on the part of any one who can recognise such a likeness.

ADDITION TO LECTURE IV.

In Lecture IV. p. 167, I stated that I should resume the consideration of Mrs. Moody's case in the Appendix, and give a traced copy of the photograph. Diagram 97 is a faithful outline copy traced from the photograph itself. The observation I have to make, in refutation of the stated resemblance, will be found as an Addition to Lecture III. p. 287.

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